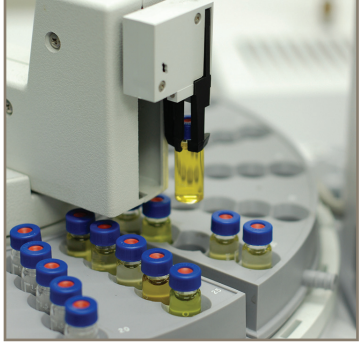

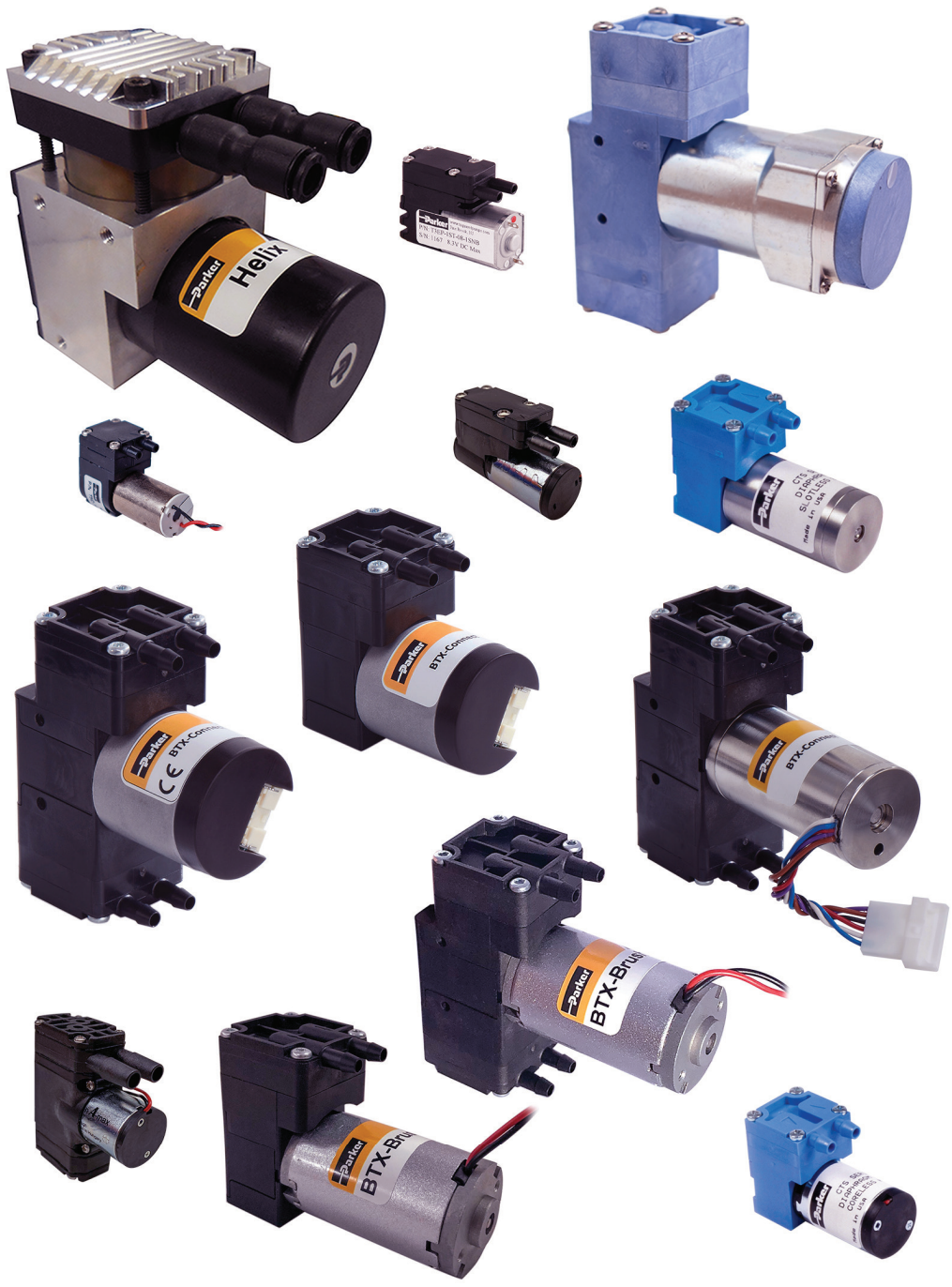

Miniature Pumps

Precision Fluidics

Parker

ENGINEERING YOUR SUCCESS.

Innovative Solutions for Health Care Success

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When you partner with the global leader in motion and control technologies, expect to move your business and the world forward. From miniature solenoid valves to highly integrated automation systems, our innovations are critical to life-saving medical devices and scientific instruments used for drug discovery and pathogen detection. Not to mention, critical to decreasing time to market and lowering your overall cost of ownership. So partner with Parker, and get ready to move, well, anything.

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Table of Contents

T2-05

Micro Diaphragm Pumps (air/gas)

Up to 800 mLPM Free Flow

Parker's T2-05 13.5 mm wide micro diaphragm pump is designed to fit where other pumps cannot due to its small, compact package size. The T2-05 flow path is optimized to deliver high flow with high efficiency resulting in extended battery life. The pump's low power, small size, and light weight play a critical role in portable gas detection and medical applications.

Markets

- Safety
- Patient Therapy
- Patient Monitoring

Applications

- Portable Gas Detection
- Gas Sampling
- Medical Instruments
- Trace Detection
- Sidestream CO_2
- Negative Pressure Wound Therapy

Features

- The valve design has been optimized to provide the highest flow rates available with the lowest current draw, allowing for longer battery life and smaller instrument size.
- The T2-05 model pump life ranges up to 10,000 rated hours depending on motor (HE, LI and IC) options
- The pump fits into the extremely tight spaces demanded of today's handheld instruments, such as portable gas detectors and portable negative pressure wound therapy devices for patient mobility. The lightweight design minimizes instrument weight.
- RoHS compliant.

Product Specifications*

Physical Properties

Operating Environment[1]:
-4 to 122°F (-20 to 50°C)
Storage Environment
-4 to 122°F (-20 to 50°C)
Media:
Air, Argon, Helium, Nitrogen, Oxygen, and other non-reacting gases
Humidity:
Most non-condensing gases 5-95% Relative Humidity
Pump Assembly Rated Life[3]:
Coreless Motor-Pump (HE): Up to 10,000 hours Coreless Motor-Pump (LI): Up to 6,000 hours PMDC Iron Core-Pump (IC): Up to 1,500 hours
Weight:
0.5 oz (14 g) HE and LI 0.4 oz (11 g) IC

Electrical

Motor Type (DC):
High Efficiency Coreless Brush (HE) Low Inductance Coreless Brush (LI) PMDC Iron Core Brush (IC)
Nominal Motor Voltages (DC)[4]:
1.9 to 4.5 Vdc
Electrical Termination:
HE: Wire Leads LI: Wire Leads IC: Solder Tabs or Wire Leads
Inductance[6]:
HE: 0.28 mH maximum @ 1kHz/50mV LI: 0.05 mH maximum @ 1kHz/50mV IC: 4.07 mH maximum @ 1kHz/50 mV

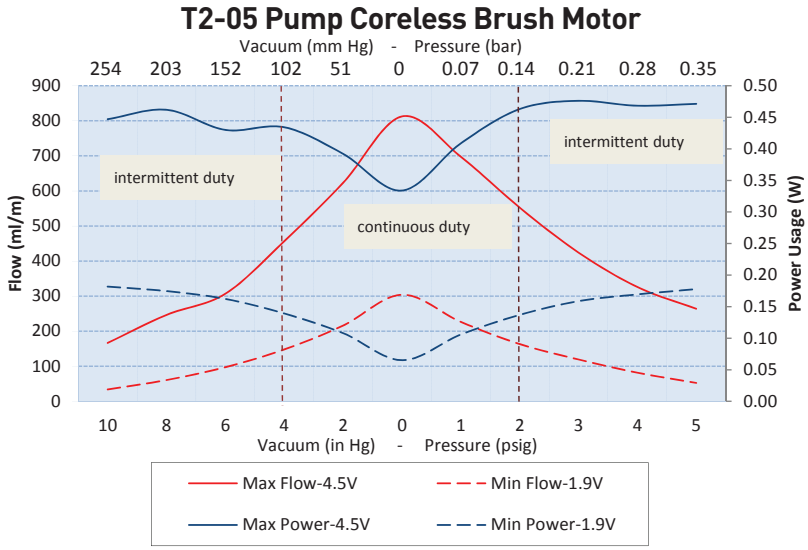
Wetted Materials

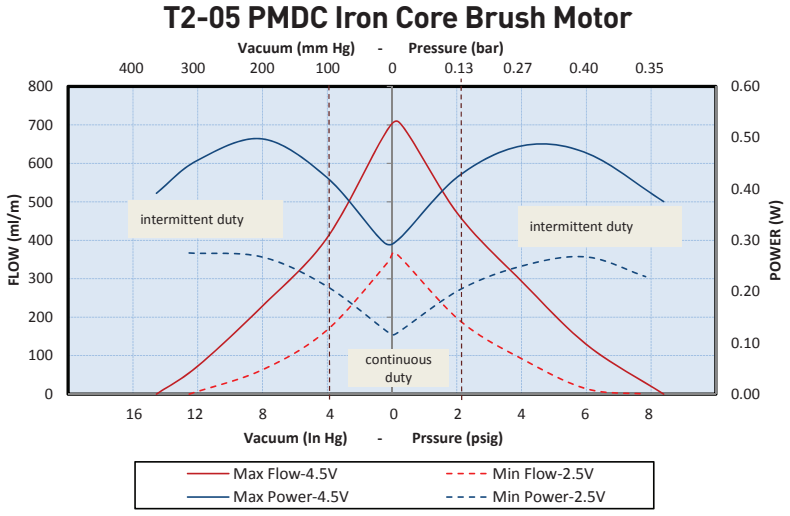
Valves: EPDM
Pump Head: ABS

Pneumatic

Head Configuration: Single
Maximum Flow:
HE, LI: 800 smlpm, IC: 700 smlpm
Maximum Intermittent Pressure[7]:
6.2 psi (430 mbar)
Maximum Continuous Pressure:
2.0 psi (138 mbar)
Maximum Intermittent Vacuum[7]:
10.8 in Hg (274 mm Hg)
Maximum Continuous Vacuum:
4.1 in Hg (104 mm Hg)
Filtration:
40 micron recommended
Efficiency at Free Flow[8]:
LPM/Watt: 4.66 @ 1.9 VDC (*P/N T5-1HE-03-1EEB*) LPM/Watt: 4.08 @ 1.9 VDC (*P/N T5-1LI-03-1EEB*) LPM/Watt: 3.12 @1.9 VDC (*P/N T5-1IC-03-1EEP*)

Performance Specifications





The above graphs represent examples of performance for the pumps series handling air at 800 feet (244M) above sea level at 75° F (24° C). Performance will vary depending on barometric pressure and media temperature. Curves are representative of standard pump configurations. Pump configurations could be customized for higher or lower flows, depending on specific customer requirements.

Please contact Parker Precision Fluidics Applications Engineering for other considerations

T2-05 Micro Diaphragm Pumps (air/gas)

Sizing and Selection

T2-05 Series	Coreless Brush Motor (High Efficiency)	Coreless Brush Motor (Low Inductance)	PMDC Iron Core Motor (Iron Core)
			
Model	**HE**	**LI**	**IC**
Inductance[6]	Better	Best	N/A
Efficiency at Free Flow[8]	Best	Best	Better
Life[3]	Best	Better	Good
Cost	Good	Better	Best

Mounting Guidelines:

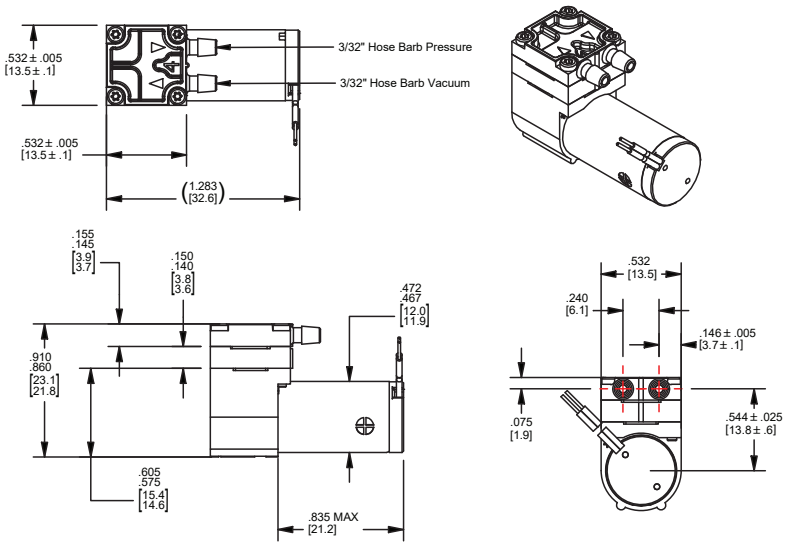
- Parker recommends using a nylon cable tie with a length of at least 4" (100 mm).

Port Connections:

- HE & LI: 3/32" ID tubing
- IC: 1/8" ID tubing

Mechanical Integration Dimensions

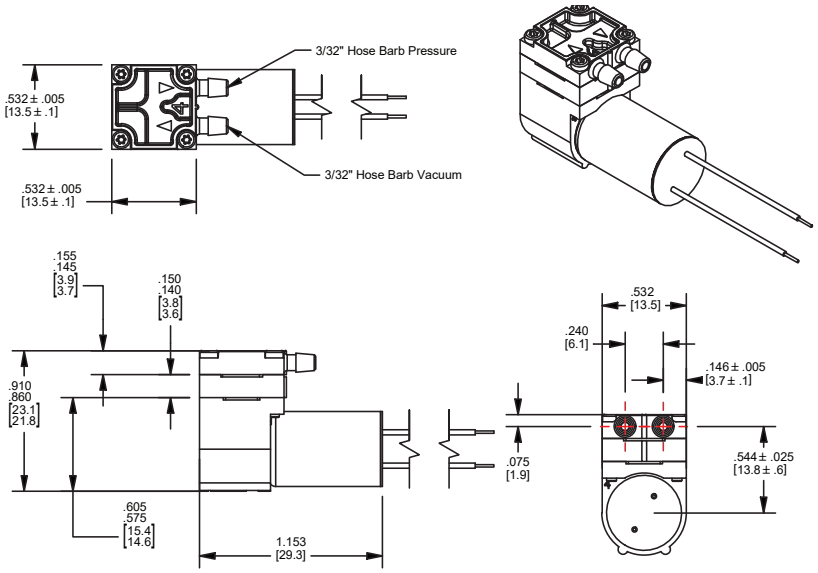
Coreless Brush/HE Version



Units
IN. [mm.]

Mechanical Integration Dimensions

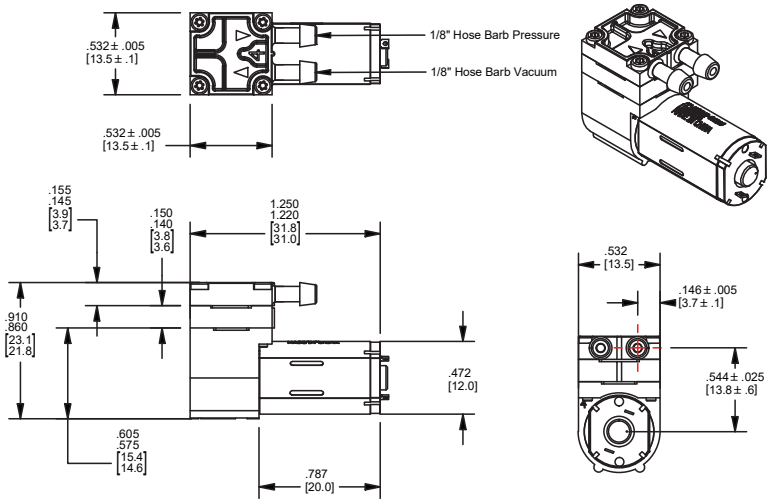
Coreless Brush/LI Version



Units
IN. [mm.]

Mechanical Integration Dimensions

PMDC Iron Core/IC Version

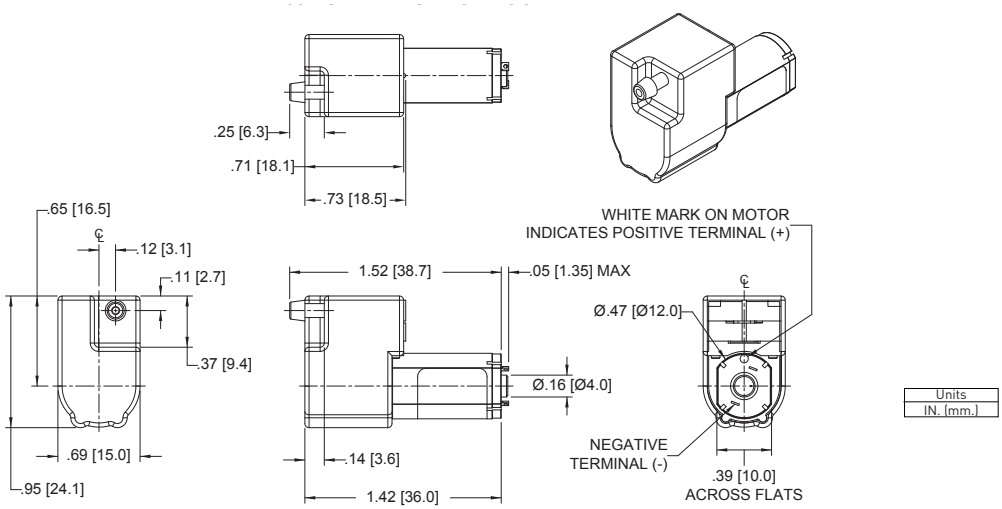


Units
IN. [mm.]

Mechanical Integration

PMDC Iron Core/IC Version

Improved Sound Configuration*



*The noise mitigation outlet cover is available for vacuum configuration only, with the PMDC Iron Core brush motor.

Electrical Integration and Motor Control

Coreless Brush Motor (HE, LI)

2 Wire	Red (+), Black (-)
Wire specification	28 AWG 5.7" (145 mm) PVC Wire Leads

PMDC Iron Core Brush Motor (IC)

2 Wire	Red (+), Black (-)
Wire specification	26 AWG 6.5" (165 mm) PVC Wire Leads

Key Things to Remember

Contact Parker Engineering for other connection requirements.

Pump life is highly dependent on operating conditions. It is not recommended to run the pump continuously, 100% duty cycle, at higher than 2 psig.

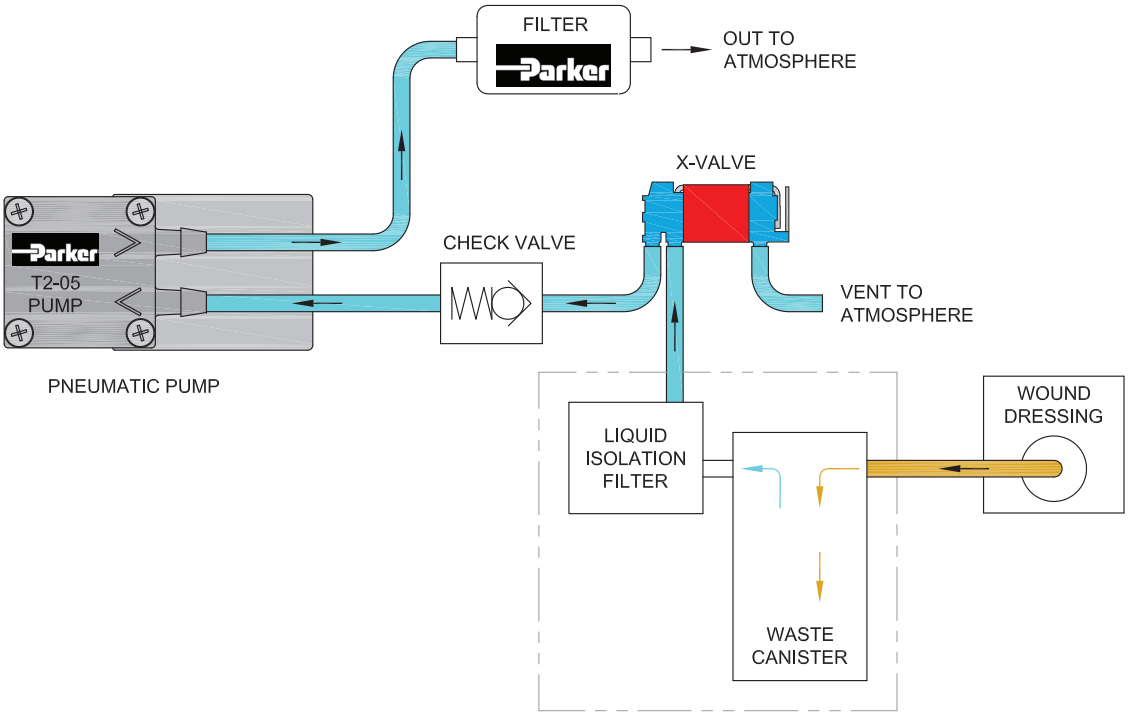
The pump flow and pressure can be controlled by adjusting the input voltage from zero to maximum rated voltage.

The pump is not a pressure holding device. An external check valve is recommended, if there is a pressure holding requirement.

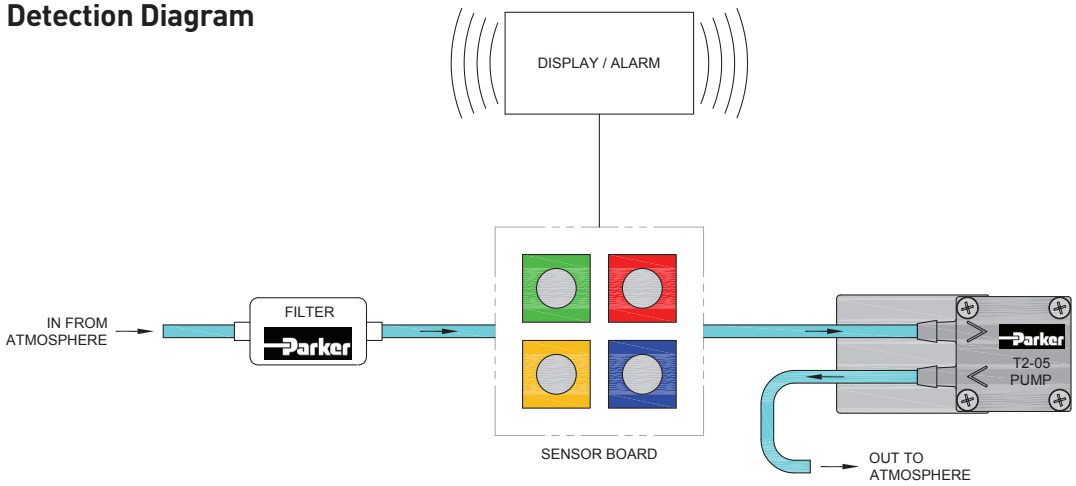
Pump orientation does not affect performance or life.

Typical Flow Diagram

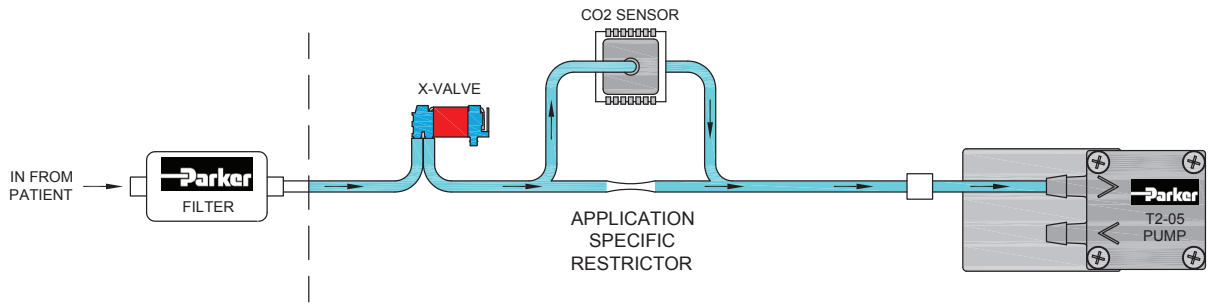
Negative Pressure Wound Therapy Diagram



Gas Detection Diagram



Side Stream Capnography Diagram



Chemical Compatibility Chart*

Chemical	Chemical Compatibility of Wetted Path Materials		
	EPDM	ABS	PBT
Air	1	1	1
Ozone (1000 ppm)	4	2	1
Oxygen	1	1	1
Ethylene (Ethene)	4	1	1
Acetylene	1	2	2
Propane	4	2	2
Methane	4	4	2
Nitrogen	1	1	1
Carbon Dioxide	2	2	1
Halothane (Up to 5%)	4	1	1

*The above is an Abbreviated Chemical Compatibility Chart. Please consult factory for details.

Compatibility Legend

1. EXCELLENT
   Minimal or no effect
2. GOOD
   Possible swelling and/or loss of physical properties
3. DOUBTFUL
   Moderate or severe swelling and loss of physical properties
4. NOT RECOMMENDED
   Severe effect and should not be considered

Note: Consult factory for other gases.

Ordering Information

Part Number	Vacuum: LPM @ Load		Free Flow	Pressure: LPM @ Load		Motor Type
	8 in Hg 203 mm Hg	4 in Hg 102 mm Hg	0	2 psig 134 mbar	4 psig 276 mbar	
T5-1HE-03-1EEB	0.2	0.5	0.8	0.6	0.3	HE - Coreless Brush
T5-1LI-03-1EEB-1	0.2	0.5	0.8	0.6	0.3	LI - Coreless Brush
T5-1IC-03-1EEP	0.2	0.5	0.7	0.5	0.3	IC - Iron Core Brush
T5-VBIC-03-1EEP	0.2	0.5	0.7			IC - Iron Core Brush
T5-1ICW-03-1EEP	0.2	0.5	0.7	0.5	0.3	IC - Iron Core Brush with Wire Leads

Ordering Information

Please refer to sizing and selection chart for identifying which one will fit your application

To order on-line go to www.parker.com/precisionfluidics/t5 and configure your T2-05 Micro Diaphragm Pump.

Serviceable – PPF products are designed for use through the rated life and Parker does not sell replacement parts, nor is it recommended to service these in the field

Note: In addition to Parker's innovative and flexible pump designs, we offer applications engineering expertise to our customers in order to configure and recommend the optimal pump for the application. Contact Parker Applications Engineering to discuss and configure alternate pump configurations to meet your specific application requirements. Providing information on the following requirements will assist us in developing an optimal solution for your application:

- Noise
- Operating Pressure / Vacuum
- Power Consumption
- Life Requirement
- Size
- Motor Control
- Media
- Voltage

Parker Hannifin Precision Fluidics Division reserves the right to make changes. Drawings are for reference only.

Appendix A

All performance data is typical based on standard conditions: 70°F and 14.7 psia (21°C and 1 bar).

1. Duty Dependent. For operation above 122°F (50°C) consult factory

2. Noise is dependent on the configuration and operation of the pump in the application. Parker has the ability to tailor the pump configuration when noise is a critical criterion in the effort to meet the performance requirements of the application. Noise level is tested to Parker protocol P-105.

3. Life rating can vary depending on application and operating conditions.

4. Custom motor options available. Custom motors may require a significant application potential. The standard motors can be configured with a special winding to meet a particular operation point at a specified voltage

5. Current range is dependent on motor type, voltage, pressure/vacuum and flow requirement. Lower levels possible depending on application.

6. Inductance is an indicator of induced voltage with change in current and it is a key parameter to enable customers' low energy intrinsic safety systems

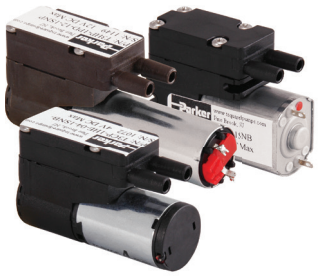
7. Maximum intermittent pressure/vacuum data is a pump capability guideline for applications that go beyond the maximum continuous levels for short periods of time. Please consult customer specific requirements with the factory or Applications Engineering.

8. Pump efficiency is a measure of the flow rate generated per unit of power consumed. Efficiency may change dependent on application and operating condition at free flow.

T2-03

Micro Diaphragm Pumps (air/gas)

Up to 2.5 LPM Free Flow



T2-03 micro diaphragm pump series is ideal for higher performance, fixed and portable air and gas detection, and medical applications requiring flow up to 2.5 lpm. T2-03 pumps are proven in fixed and portable applications for sampling of hazardous gases and vapors typical of industrial and mining operations.

Applications

- Gas Sampling
- Fixed Gas Detectors
- Medical Instruments
- Aerosols and Particle Analysis
- Combustion Analyzers

Features

- The valve design has been optimized to provide the highest flow rates available with the lowest power draw in this package size. Lower power results in longer battery life and smaller instrument size.
- The wear components of these pumps have been designed to provide maximum life. Many applications for these pumps require 10,000+ hours of operation.
- The pumps fit into the extremely tight spaces demanded of today's handheld instruments, such as portable gas detectors and portable instruments such as handheld gas detectors and medical devices. The lightweight design minimizes instrument weight.
- RoHS compliant.

Product Specifications*

Physical Properties

Operating Environment[1]
32 to 122°F (0 to 50°C)
Storage Environment:
14 to 122°F (-10 to 50°C)
Humidity:
5-95% Relative Humidity
Noise Level[2]:
As low as 45dB
Pump Assembly Rated Life[3]:
eCompact - 5,000 hrs Compact - 10,000 hrs HP - 10,000 hrs *Pressure and speed dependent.*
Weight:
1.2 oz. (33 g) eCompact 1.2 oz. (33 g) Compact 1.5 oz. (42 g) HP

Wetted Materials

Diaphragm:
Neoprene, EPDM, FKM
Valves:
Silicone, FKM
Pump Head:
ABS, PPS

Electrical

Motor Type:
PMDC Iron Core Brush, Coreless Brush
Nominal Motor Voltages[4]:
4, 5.6, 8.3, 12.4 VDC
Max Power at Nominal Voltage:
eCompact - PMDC Iron Core Brush 2.4 Watts (298 mA @ 8VDC) Compact - Coreless Brush Motor 2.3 Watts (386 mA @ 6 VDC) HP - Coreless Brush Motor 0.7 Watts (88 mA @ 8 VDC)
Electrical Termination:
PMDC Iron Core Brush - Solder Tabs Coreless Brush - 5.7 in (145 mm) Wire Leads
Current Range[5]:
18 - 411 mA
Inductance[6]:
eCompact: 18.64 mH max@1kHz/50mV Compact: 0.47 mH max@1kHz/50mV HP: 3.4 mH max@1kHz/50mV

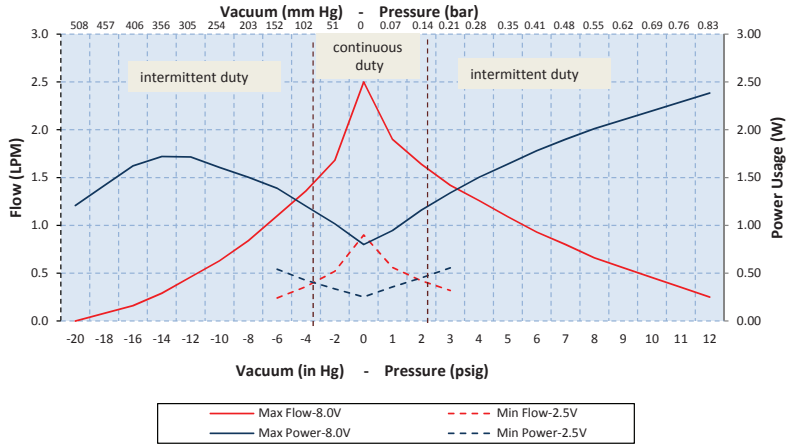
Pneumatic

Head Configuration:
Single
Maximum Flow:
2.5 LPM
Maximum Continuous Pressure:
2 psi (138 mbar) - eCompact PMDC Iron Core Brush, Compact Coreless Brush Motor 8 psi (555 mbar) - HP Coreless Brush Motor
Maximum Continuous Vacuum:
eCompact PMDC Iron Core Brush 4 inHg (102 mmHg) Compact Coreless Brush Motor 4 inHg (102 mmHg) HP Coreless Brush Motor 12 inHg (305 mmHg)
Filtration:
40 micron recommended
Efficiency at Free Flow[8]:
eCompact PMDC Iron Core Brush Motor: 3.56 LPM/Watt (*P/N: T3EP-1ST-05-3FFP*) Compact Coreless Brush Motor: 11.92 LPM/Watt (*P/N: T3CP-1HE-04-2SEB*) HP Coreless Brush Motor: 15.28 LPM/Watt (*P/N: T3HP-1PD-12-1SNP*)

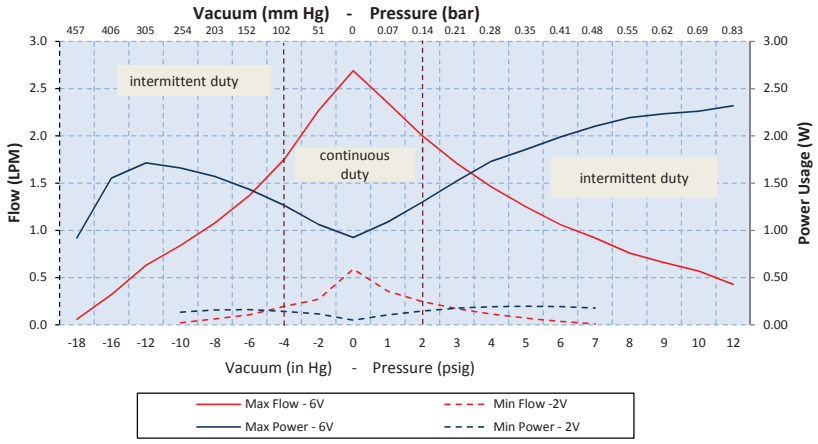
* See Appendix A for details.

Performance Specifications

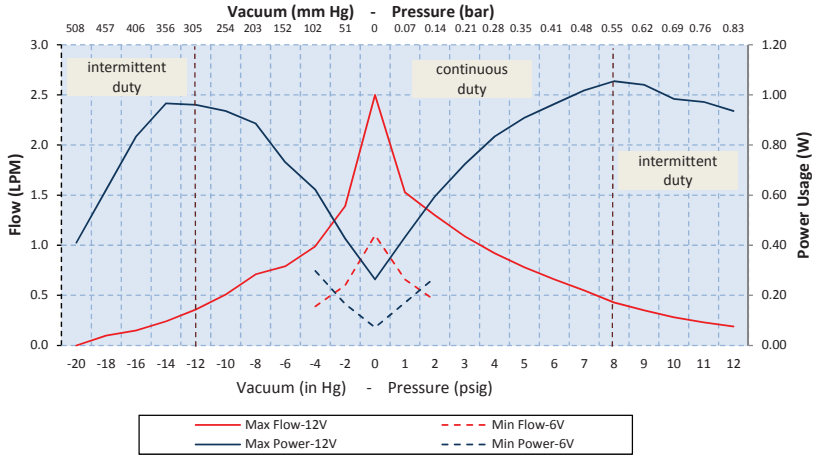
T2-03 e-Compact - PMDC Iron Core Motor



T2-03 Compact Pump - Coreless Brush Motor



T2-03 HP - Coreless Brush Motor



The above graphs represent examples of performance for the pumps series handling air at 800 feet (244M) above sea level at 75° F (24° C). Performance will vary depending on barometric pressure and media temperature. Curves are representative of standard pump configurations. Pump configurations could be customized for higher or lower flows, depending on specific customer requirements.

Please contact Parker Precision Fluidics Applications Engineering for other considerations.

T2-03 Micro Diaphragm Pumps (air/gas)

Sizing and Selection

T2-03 Series	PMDC Iron Core Brush Motor (eCompact)	Coreless Brush Motor (Compact)	Coreless Brush Motor (HP)
			
	eCompact	**Compact**	**HP**
Inductance[6]	Good	Best	Better
Efficiency at Free Flow[8]	Good	Better	Best
Life[3]	Good - 5,000 hours	Best - 10,000 hours	Best - 10,000 hours
Size/Weight	Better	Best	Good
Cost	Best	Better	Good

Mounting Guidelines:

- For eCompact, Parker recommends mounting with (2) #1 screw or using a nylon cable tie with a length of at least 4" (100 mm)
- For Compact & HP, Parker recommends using a nylon cable tie with a length of at least 4" (100 mm)

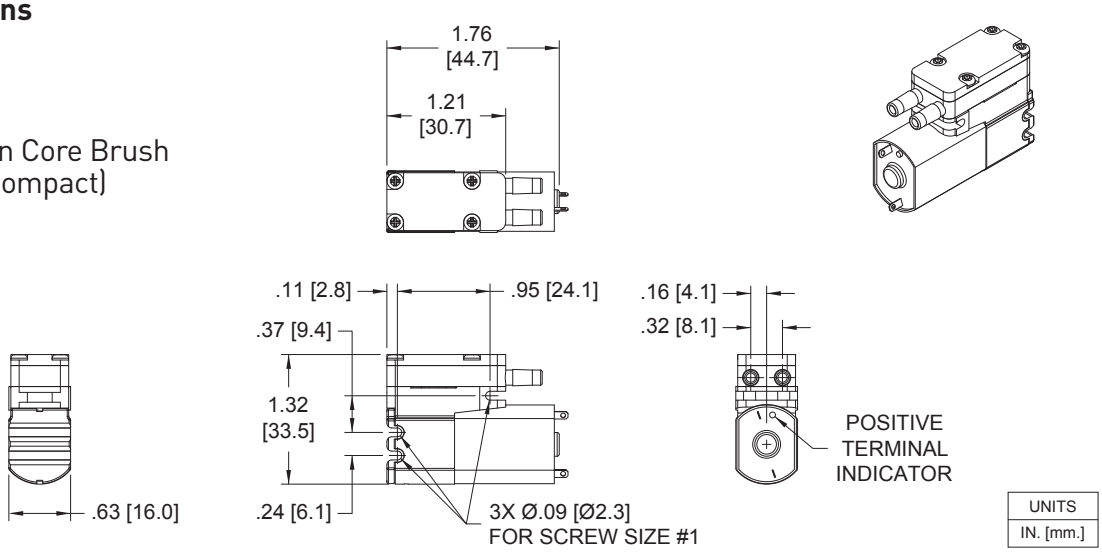
Port Connections:

- Barbs are sized for 1/8" ID tubing, 70-80 durometer recommended.
- Flow direction is marked on the pump head with arrows.

Mechanical Integration

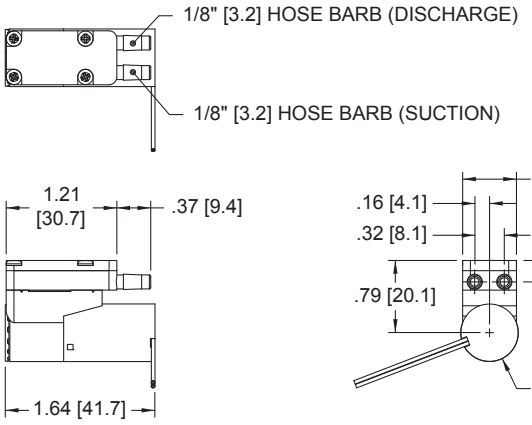
Dimensions

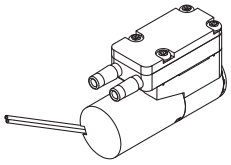
PMDC Iron Core Brush Motor (eCompact)



Dimensions

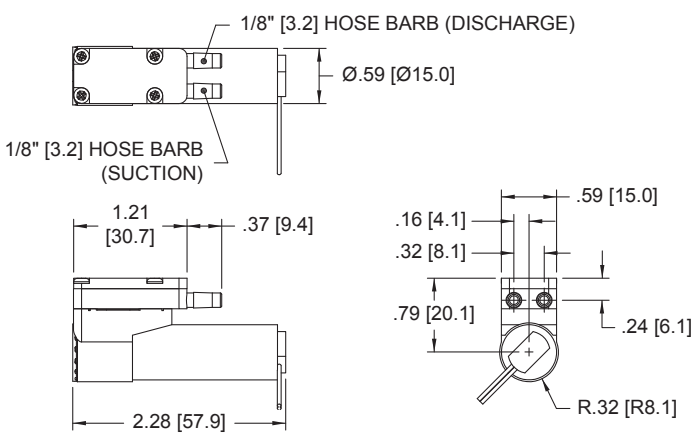
Coreless Brush Motor (Compact)

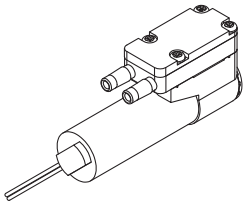




UNITS
IN. [mm.]

Coreless Brush Motor (HP)





UNITS
IN. [mm.]

Electrical Integration and Motor Control

If application requires variable flow, motor control options are available, as follows:

PMDC Iron Core Brush Motor (eCompact)

2 Solder Tabs	Positive terminal marked on pump motor

Coreless Brush Motor (Compact & HP)

2 Wire	Red (+), Black (-)
Wire specification	28 AWG Wire lead length 5.7" (145 mm)

Electrical Integration and Motor Control cont'd

Key Things to Remember

5" (127 mm) flying Leads are the standard electrical connection method to the pump (eCompact standard connection is tabs). Contact Applications for other connection requirements.

The pump lead wires are non-polarized.

The pump can be controlled by DC voltage or PWM. The minimum recommended PWM frequency is 20kHz.

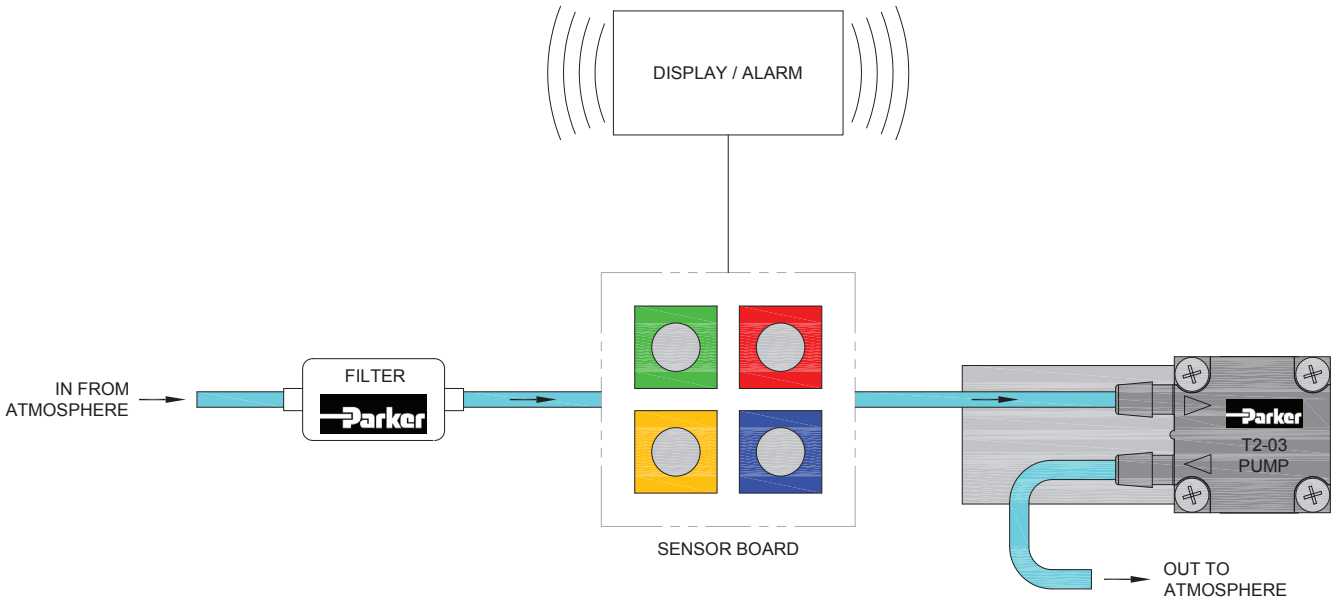
The pump flow and pressure can be controlled by adjusting the input voltage from zero to maximum rated voltage.

The pump is not a pressure holding device. An external check valve is recommended, if there is a pressure holding requirement.

Pump orientation does not affect performance or life.

Typical Flow Diagram

Hand Held Gas Detection



Chemical Compatibility Chart*

	Chemical Compatibility of Wetted Path Materials					
Chemical	FKM	EPDM	ABS	Neoprene Rubber(CR)	PPS	Silicone
Air	1	1	1	1	1	1
Ozone (1000 ppm)	4	4	2	3	1	1
Oxygen	1	1	1	1	1	2
Ethylene (Ethene)	1	4	-	1	1	4
Acetylene	1	1	2	2	1	3
Propane	1	4	2	1	1	4
Methane	1	4	4	2	1	4
Nitrogen	1	1	1	1	1	1
Carbon Dioxide	1	2	2	1	1	2
Halothane (Up to 5%)	1	4	1	4	1	4

*The above is an Abbreviated Chemical Compatibility Chart. Please consult factory for details.

Compatibility Legend

1. EXCELLENT
   Minimal or no effect
2. GOOD
   Possible swelling and/or loss of physical properties
3. DOUBTFUL
   Moderate or severe swelling and loss of physical properties
4. NOT RECOMMENDED
   Severe effect and should not be considered

Note: Consult factory for other gases.

Ordering Information

T2-03 Micro Pumps

Configuration	Vacuum: LPM @ Load					Free Flow	Pressure: LPM @ Load					Max					PCD[1]	Wetted Materials[2]
	18 in Hg 457 mm Hg	16 in Hg 406 mm Hg	12 in Hg 305 mm Hg	8 in Hg 203 mm Hg	4 in Hg 102 mm Hg	0	2 psig 134 mbar	4 psig 276 mbar	6 psig 414 mbar	8 psig 552 mbar	10 psig 689 mbar	Vac in Hg	Press psig	Motor Type	VDC	mA	Diaphragm, Valves, Gasket
T3CP-1HE-04-1SNB				0.3	0.9	**2.5**	1.1	0.5				8.6	4.5	Coreless Brush	4	313	CR, VMQ, CR
T3CP-1HE-04-2SEB				0.1	0.3	**1.1**	0.5	0.2				10.4	5.5	Coreless Brush	4	103	EPDM, VMQ, CR
T3CP-1HE-06-1SNB				0.6	1.2	**2.8**	1.5	0.8	0.5			12.2	6.5	Coreless Brush	6	317	CR, VMQ, CR
T3EP-1ST-05-3FFP			0.3	0.6	0.8	**1.5**	1.2	0.7	0.6	0.4		16.7	11.7	PMDC Brush	5.6	411	FKM
T3EP-1ST-08-1SNB		0.2	0.6	0.7	1.3	**2.5**	1.6	1.2	0.7	0.6		20.8	10.5	PMDC Brush	8.3	385	CR, VMQ, CR
T3HP-1PD-12-1SNP		0.2	0.4	0.7	1.0	**2.5**	1.3	0.9	0.7	0.4	0.3	18.0	12	Coreless Brush	12.4	97	CR, VMQ, CR

1. PCD: Peak Current Draw 2. CR: Neoprene, VMQ: Silicone, FKM: Fluorocarbon, EPDM: Ethylene Propylene Diene Monomer

To order on-line go to www.parker.com/precisionfluidics/t3 and configure your T2-03 Micro Diaphragm Pump.

Serviceable – PPF products are designed for use through the rated life and Parker does not sell replacement parts, nor is it recommended to service these in the field

Note: In addition to Parker's innovative and flexible pump designs, we offer applications engineering expertise to our customers in order to configure and recommend the optimal pump for the application. Contact Parker Applications Engineering to discuss and configure alternate pump configurations to meet your specific application requirements. Providing information on the following requirements will assist us in developing an optimal solution for your application:

- Noise
- Operating Pressure / Vacuum
- Power Consumption
- Life Requirement
- Size
- Motor Control
- Media
- Voltage

Parker Hannifin Precision Fluidics Division reserves the right to make changes. Drawings are for reference only.

Appendix A

All performance data is typical based on standard conditions: 70°F and 14.7 psia (21°C and 1 bar).

1. Duty Dependent. For operation above 122°F (50°C) consult factory

2. Noise is dependent on the configuration and operation of the pump in the application. Parker has the ability to tailor the pump configuration when noise is a critical criterion in the effort to meet the performance requirements of the application. Noise level is tested to Parker protocol P-105.

3. Life rating can vary depending on application and operating conditions.

4. Custom motor options available. Custom motors may require a significant application potential. The standard motors can be configured with a special winding to meet a particular operation point at a specified voltage

5. Current range is dependent on motor type, voltage, pressure/vacuum and flow requirement. Lower levels possible depending on application.

6. Inductance can be used to measure the viability of a component in a device requiring intrinsic safety.

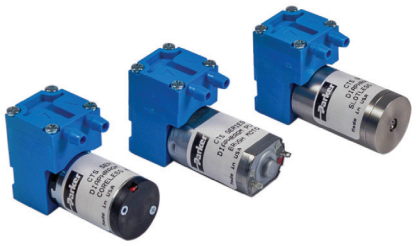
7. Maximum intermittent pressure/vacuum data is a pump capability guideline for applications that go beyond the maximum continuous levels for short periods of time. Please consult customer specific requirements with the factory or Applications Engineering.

8. Pump efficiency is a measure of the flow rate generated per unit of power consumed. Efficiency may change dependent on application and operating condition at free flow.

CTS Series

2.5 LPM Free Flow

Micro Diaphragm Pumps (air/gas)



Parker's CTS Micro Diaphragm Pump Model delivers up to 2.5 slpm of flow into a compact 20 mm wide package. Configurable with three different motors to meet your application's specific needs and life expectations

Features

- CTS Series Pumps set the highest benchmark for life-expectancy with our advanced proprietary diaphragm elastomer.
- CTS Series Pumps have a unique, compact, and lightweight design making it ideal for portable applications.
- Our 100% oil and grease-free pump and compressor design maintains the purity of your system and are commonly used in FDA-approved systems.
- CTS Series Pumps are uniquely balanced to minimize noise and vibration and to maximize life.
- RoHS compliant.

Applications

- Gas Analyzers
- Patient Monitoring
- CO_2 Monitors
- Compression Therapy
- Negative Pressure Wound Therapy
- Surgical Instruments
- Medical Consumer Devices

Product Specifications*

Physical Properties

Operating Environment[1]:
41 to 122°F (5 to 50°C)
Storage Environment:
-4 to 212°F (-20 to 100°C)
Media:
Air, Argon, Helium, Nitrogen, Oxygen, and other non-reacting gases
Humidity:
0 – 80% Relative Humidity
Pump Assembly Rated Life[3]:
PMDC Iron Core Brush - up to 1,500 hrs Coreless Brush - up to 3,000 hrs Brushless Slotless - > 10,000 hrs
Weight:
1.7 oz. (48 g) PMDC Iron Core Brush 1.6 oz. (45 g) Coreless Brush 2.2 oz. (62 g) Brushless Slotless

Electrical

Motor Type (DC):
PMDC Iron Core Brush Coreless Brush Brushless Slotless
Nominal Motor Voltages[4]:
PMDC Iron Core Brush: 6, 9, 12 Coreless Brush: 6, 9, 12, 24 VDC Brushless Slotless: 6, 9, or 12 VDC *Other voltages available upon request.*
Max Power at Nominal Voltage:
See Performance Specification Curves
Electrical Termination:
Iron Core Brush: Metal Terminals Brush: 24 AWG Wire Leads, Length 20" (508 mm) Brushless Slotless: 24 AWG Wire Leads, Length 20" (508 mm)

Pneumatic

Head Configuration:
Single
Maximum Unrestricted Flow:
2.5 LPM (See Performance Specifications)
Pressure Range:
0 - 24 psig (0 - 1.65 bar)
Vacuum Range:
0 - 20 in Hg (0 - 508 mm Hg)
Filtration:
40 microns - recommended

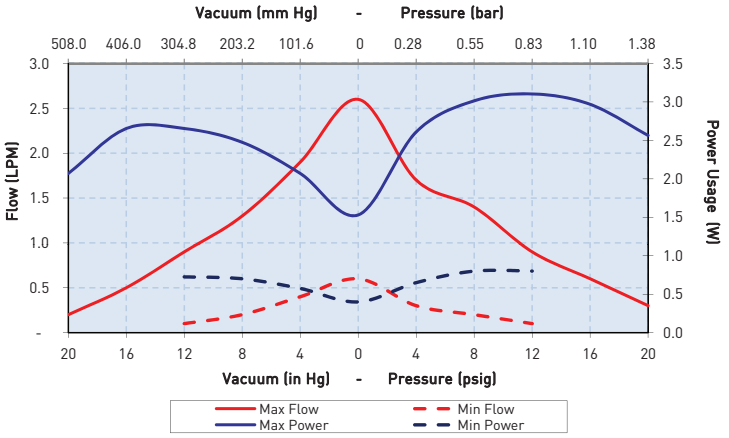
Wetted Materials

Diaphragm:
EPDM, AEPDM, FKM
Valves:
EPDM, AEPDM, FKM
Pump Head:
PSU (Polysulfone)

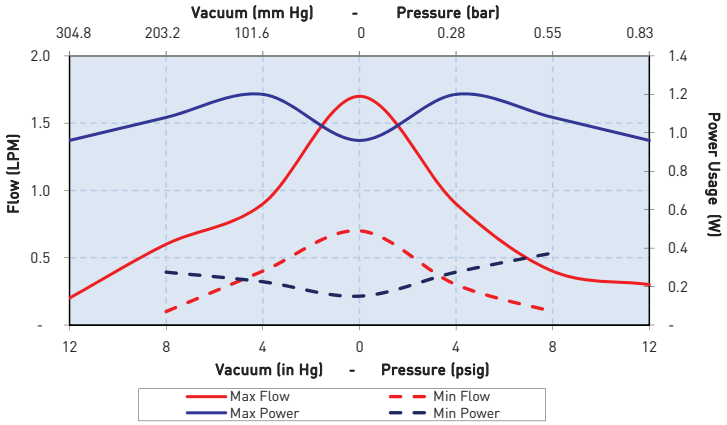
* See Appendix A for details.

Performance Specifications

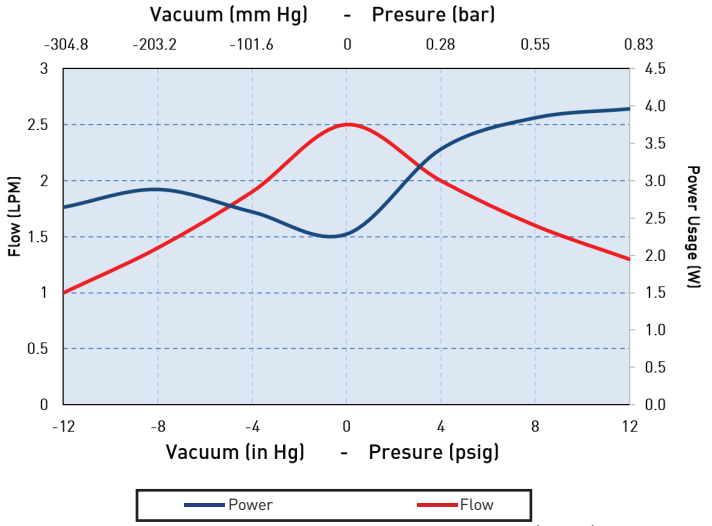
CTS - PMDC Iron Core Brush



CTS - Coreless Brush Motor



CTS - Brushless Slotless Motor



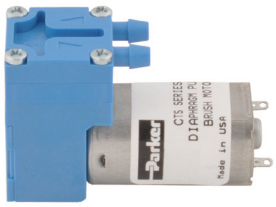
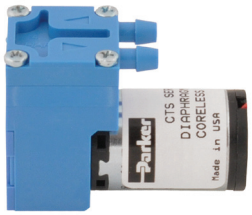
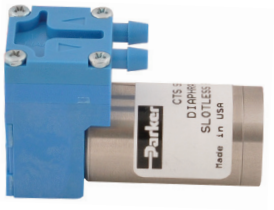
The above graphs represent an example of performance for the pump series handling air at 800 feet (244 m) above sea level at 75°F (24°C). Performance will vary depending on barometric pressure and media temperature. A variety of configurations can be accommodated to meet application requirements. Curves are representative of standard pump configurations. Pump configurations could be customized for higher or lower flows depending on specific customer requirements.

Please contact Parker Precision Fluidics Applications Engineering for other considerations.

CTS Series

Micro Diaphragm Pumps (air/gas)

Sizing and Selection

CTS Series	PMDC Iron Core Brush	Coreless Brush Motor	Brushless Slotless Motor
			
	PMDC Iron Core Brush	**Coreless Brush Motor**	**Brushless Slotless Motor**
Efficiency[1]	Good	**Best** - Brush Motor Efficiency Up to 90% motor efficiency	**Better** Up to 75% motor efficiency
Life[2]	**Good** - up to 1,500 hrs	**Better** - up to 3,000 hrs	**Best** - 10,000 hrs
Cost	Best	Better	Premium
Noise	Good	Better	Best

See Appendix A for details.

Mounting Guidelines:

- Mounting may be accomplished by using double-sided tape or wire zip ties secured to the motor housing or using a nylon cable tie with a length of at least 4" (100 mm).
- Hole in the center of the bottom of housing is for manufacturing only–not to be used for mounting.

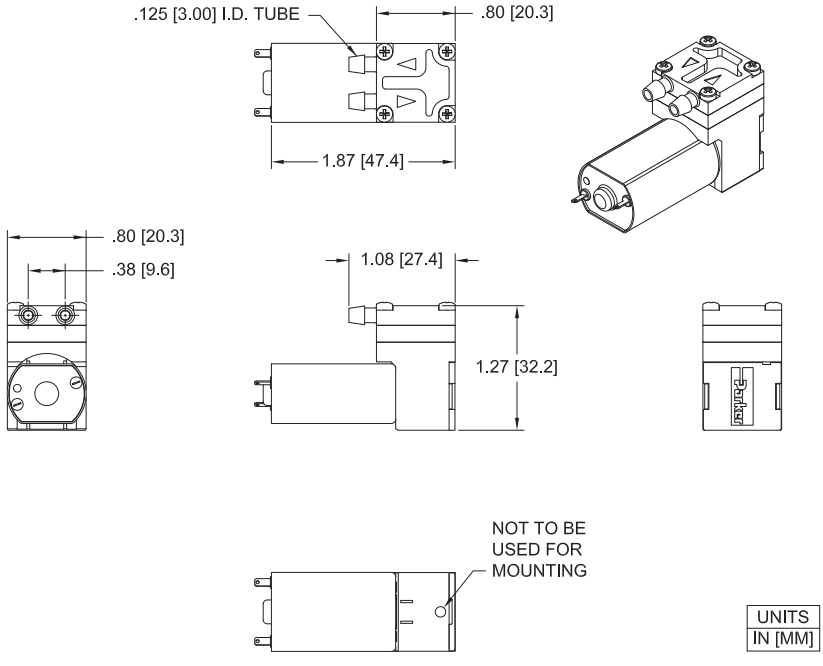
Port Connections:

- Barbs are sized for 1/8" (3 mm) ID tubing, 70-80 durometer recommended.
- Flow direction is marked on the pump head with arrows.

Mechanical Integration

Dimensions

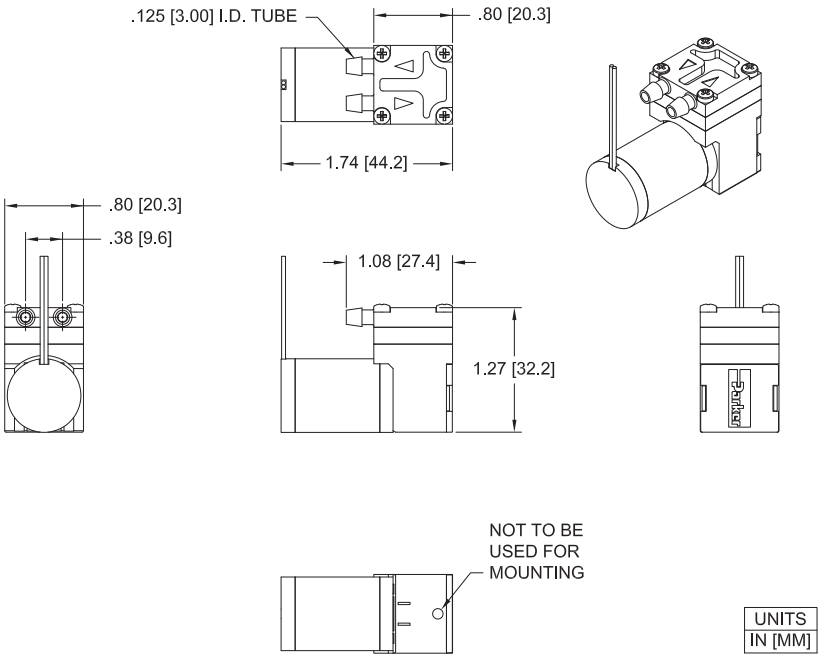
PMDC Iron Core Brush



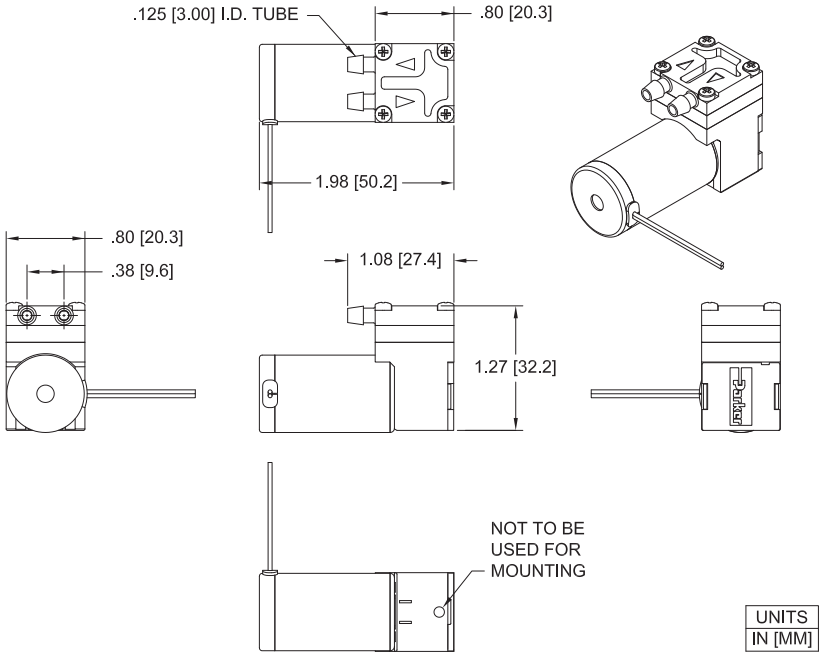
Mechanical Integration

Dimensions

Coreless Brush Motor



Brushless Slotless Motor



Electrical Integration and Motor Control

PMDC Iron Core Brush Motor

Metal Terminals	Polarity of the terminals is marked on the motor with the red dot marking the positive terminal.

Coreless Brush Motor

2 Wire	Red (+), Black (-)
Wire specification	24 AWG, Insulation OD 0.038 in (0.97 mm), 20" (508 mm) Wire Leads

Brushless Slotless

2 Wire	Red (+), Black (-)
Wire specification	24 AWG, Insulation OD 0.042 in (1.07 mm), 20" (508 mm) Wire Leads

Key Things to Remember

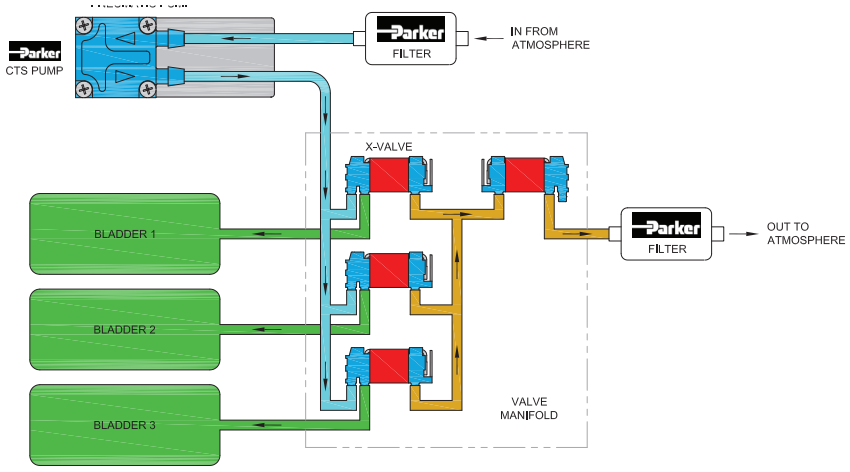
The pump is not a pressure holding device. An external check valve is recommended, if there is a pressure holding requirement.

Onboard PWM control is not provided with this pump.

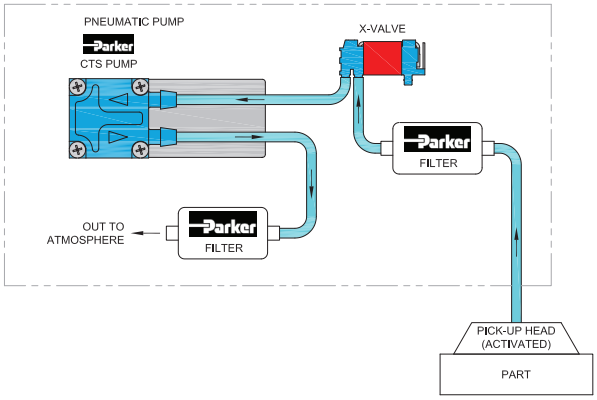
Pump orientation does not affect performance or life.

Typical Flow Diagram

Compression Therapy Prevention (DVT)

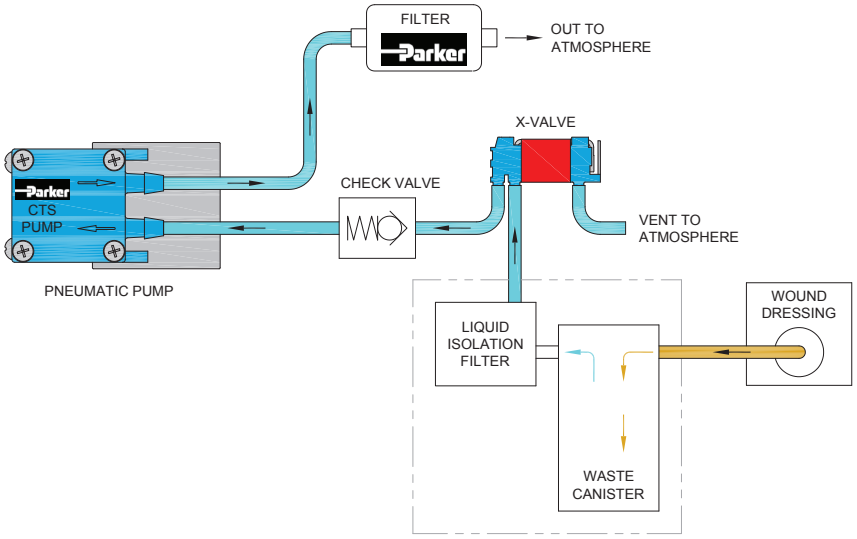


Pick-up Head

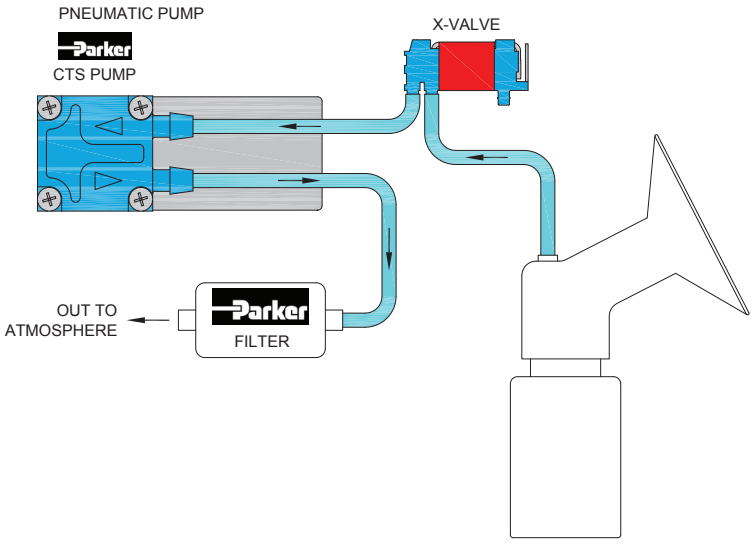


Typical Flow Diagram

Negative Pressure Wound Therapy (NPWT)



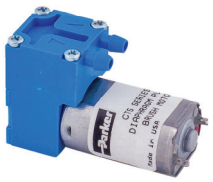
Breast Pump



CTS Series

Micro Diaphragm Pumps (air/gas)

Ordering Information

Configuration	Voltage	Speed at Nominal Voltage	Part Number	-16 inHg -406 mmHg	-12 inHg -305 mmHg	-8 inHg -203 mmHg	-4 inHg -102 mmHg	0 Free Flow	4 PSIg 276 mbar	8 PSIg 552 mbar	12 PSIg 827 mbar
CTS Iron Core Brush Motor 	6	3940	E155-11-060	-	0.15	0.32	0.52	0.78	0.48	0.29	0.14
	9	6050	E163-11-090	-	0.19	0.52	0.80	1.53	0.82	0.46	0.19
	12	8460	E155-11-120	-	0.27	0.81	1.24	1.73	1.18	0.66	0.35
	6	7310	E161-11-060	-	0.20	0.65	1.00	1.78	1.01	0.54	0.15
	6	5000	E265-13	-	-	-	-	1.60	1.20	0.90	0.70
	9	7350	E107-13-090	-	-	-	-	2.50	1.70	1.40	0.90
	12	7570	E129-13-120	-	-	-	-	2.60	1.80	1.40	1.00
	6	4850	E107-12-060	0.22	0.47	0.74	1.08	1.88	-	-	-
	6	6600	E253-12	-	0.90	1.30	1.70	2.30	-	-	-
	12	7900	E129-12-120	0.50	0.90	1.40	1.90	2.50	-	-	-
	9	7450	E107-12-090	0.50	0.90	1.30	1.90	2.60	-	-	-
CTS Coreless Motor 	5	2800	E134-11-050	-	0.10	0.21	0.35	0.54	0.31	0.16	-
	6	6700	E164-11-060	-	0.26	0.58	0.96	1.36	0.88	0.54	-
	9	8350	E165-11-090	-	0.35	0.73	1.10	1.60	1.10	0.75	0.46
	12	7000	E134-11-120	-	0.20	0.60	0.90	1.70	0.90	0.45	0.30
	12	6950	E146A-12	0.40	0.70	1.05	1.50	2.10	-	-	-
	9	7600	E245-12	0.50	0.90	1.30	1.80	2.40	-	-	-
CTS Brushless DC Motor 	6	3950	E243-11	-	0.17	0.34	0.55	0.74	0.53	0.34	0.16
	12	8000	E258-11	-	-	0.32	0.68	1.00	0.67	0.22	-
	9	6000	E244-11	-	0.29	0.54	0.92	1.39	0.88	0.60	0.22
	12	8000	E257-11	-	-	0.78	1.15	1.75	1.10	0.70	-
	5	4200	E256-13	-	-	-	-	1.30	0.95	0.70	0.50
	5	4150	E256-12	0.25	0.49	0.72	1.00	1.32	-	-	-
	12	7650	E259-12	0.40	1.00	1.40	1.90	2.50	-	-	-

*PCD: Peak Current Draw

Note: The Ordering Information Section includes a few selected part numbers for the product line. Other performances and configurations are available. Please contact your Sales Representative or an Application Engineer to discuss your application needs.

Chemical Compatibility Chart*

Chemical	Chemical Compatibility of Wetted Path Materials			
	FKM	EPDM	AEPDM	PSU
Air	1	1	1	1
Ozone (1000 ppm)	4	4	4	1
Oxygen	1	1	1	1
Ethylene (Ethene)	1	4	1	1
Acetylene	1	1	1	1
Propane	1	4	4	1
Methane	1	4	4	1
Nitrogen	1	1	1	1
Carbon Dioxide	1	2	2	1
Halothane (Up to 5%)	1	4	4	-

*The above is an Abbreviated Chemical Compatibility Chart. Please consult factory for details.

Compatibility Legend

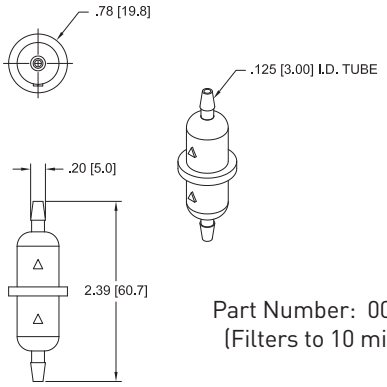
1. EXCELLENT
   Minimal or no effect
2. GOOD
   Possible swelling and/or loss of physical properties
3. DOUBTFUL
   Moderate or severe swelling and loss of physical properties
4. NOT RECOMMENDED
   Severe effect and should not be considered

Note: Consult factory for other gases.

Accessory Information

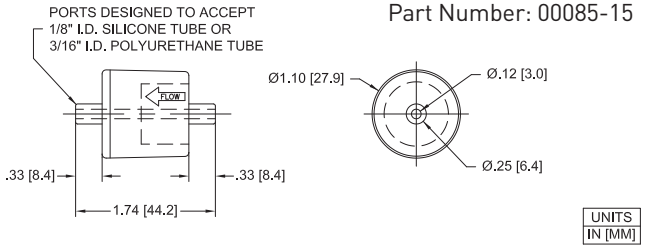
A **Filter-Muffler** is always recommended in the air inlet or outlet to reduce noise and risk of debris that may affect pump performance. See ***Typical Flow Diagrams*** for installation guidelines and Note 2 in Appendix at the end on noise

Typically a 40 micron filter is recommended to be supplied by the customer. Following are three other options of filtering specifications



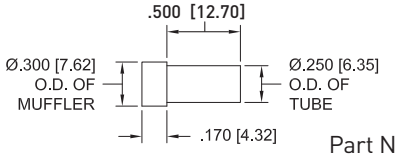
Part Number: 00492-15
(Filters to 10 microns)

UNITS IN [MM]

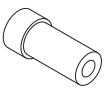


Part Number: 00085-15

UNITS IN [MM]



Part Number: 01504-10-0001



Accessory Ordering Information

Part No.	Filtering Level (Micron)	Filter Area	Operating Limitations		Wetted Materials
00492-15	10	1.71 in sq (11 sq cm)	Max Temperature 80°c	Min Temperature 32°c	Polypropylene
01540-10-0001	75-90	.02 in sq (16 sq mm)	80°c	32°c	Polyethylene
00085-15	0.01	.39 in sq (252 sq mm)	110°c	32°c	Nylon
	Filter-Mufflers: To assist with filtration and optimize noise reduction. Tubing: Recommendation 1/8" ID.				

To order on-line go to www.parker.com/precisionfluidics/cts) and configure the CTS Miniature Diaphragm Pump.

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- Operating Pressure / Vacuum
- Power Consumption
- Life Requirement
- Function in the Application
- Size
- Motor Control
- Media
- Voltage

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3. Life rating can vary depending on application and operating conditions.
4. Custom motor options available. Custom motors may require a significant application potential. The standard motors can be configured with a special winding to meet a particular operation point at a specified voltage
5. Current range is dependent on motor type, voltage, pressure/vacuum and flow requirement. Lower levels possible depending on application.

BTX-Connect Miniature Diaphragm Pump

Up to 11 LPM Free Flow

Parker's BTX-Connect pump product line combines best in class diaphragm pump design, innovative 'connected' brushless motor technology, ultra-low vibration, and advanced manufacturing techniques to bring a next-generation solution to next-generation device needs. The BTX-Connect Pump is designed to provide high performance with superior quality and reliability. The options for Motor Control, Single Head, Dual Head, Pressure only, Vacuum only, and Pressure/Vacuum configurations offer a wide range of solutions with the support of Parker's Global Teams.

Applications

- Point of Care Diagnostics
- Negative Pressure Wound Therapy
- Compression Therapy
- Medical Simulation
- Scent Dispersion

Features

"Connected" brushless motor design with digital communication control and monitoring available

Fail-safe design with over-current, stall, and over-temperature shut-down

Optimized pump balancing for ultra-low vibration

RoHS, REACH, and CE compliant

Product Specifications

Physical Properties

Operating Environment[1]:
41 to 122°F (5 to 50°C)
Storage Environment:
-4 to 212°F (-20 to 100°C)
Media:
Air, Nitrogen, Oxygen, and other non-reacting gases
Humidity:
0 - 80% Relative Humidity Non-condensing
Noise Level[2]:
As low as 45 dB @ 12 in (30 cm)
Muffler recommended for additional noise reduction (see accessories)
Pump Assembly Rated Life[3]:
Brushless Motor - 15,000 Hours
Weight:
Compact BLDC Single Head 4.4 oz (125 g)
Compact BLDC Dual Head 5.8 oz (165 g)
Slotless BLDC Single Head 7.4 oz (209 g)
Slotless BLDC Dual Head 8.4 oz (240 g)

Wetted Materials

Diaphragm:
Long Life - Advanced EPDM
Valves:
EPDM, Advanced EPDM
Pump Head:
PBT

Other materials available upon request

Electrical

Motor Type (DC):
Brushless Slotted, Brushless Slotless
Nominal Motor Voltages[4]:
12 or 24 VDC
Electrical Termination:
Mating Connector: JST PAP-06V-S
Pin 1: Tachometer Speed (Blue)
Pin 2: PWM or 0-5V Input (White)
Pin 3: +DC Voltage Input (Red)
Pin 4: -Ground (Black)
Pin 5: Digital UART Rx (Brown)
Pin 6: Digital UART Tx (Purple)

Pneumatic

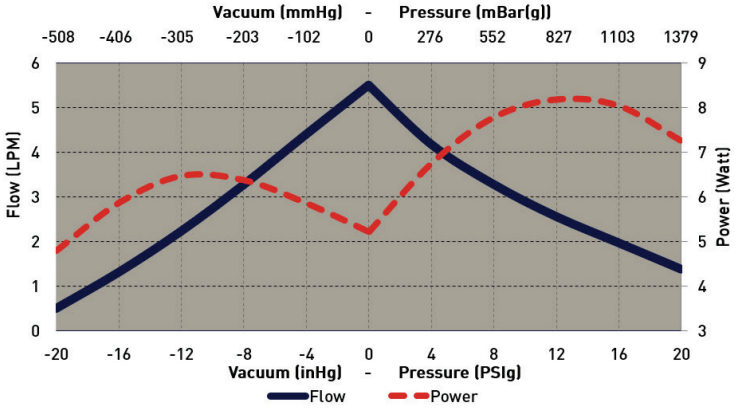
Maximum Unrestricted Flow:
Single Head: Up to 6 LPM
Dual Head: Up to 11 LPM
Pressure Range:
Continuous Duty: Up to 30 PSIg (2 Bar)
Vacuum Range:
Continuous Duty: Up to -22 inHg (-558 mmHg)
Filtration:
40 microns - recommended

Connect Features

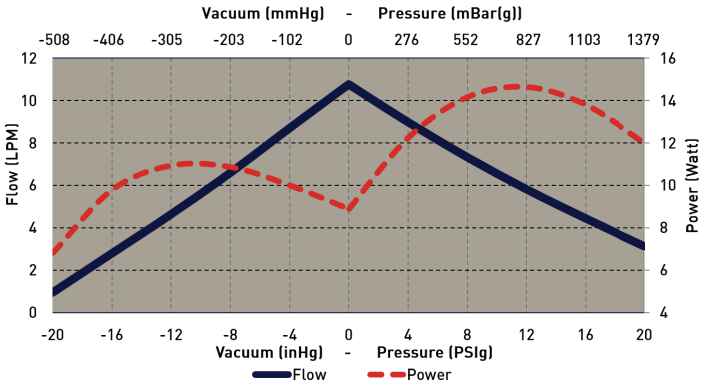
Speed Control Options:
On/Off Control, Factory Set Speed
PWM
0-5V Analog
Serial UART
Current Limit Shut Down:
Compact BLDC 12V - 1 Amp
Compact BLDC 24V - 0.5 Amp
Slotless BLDC 12V - 2 Amp
Slotless BLDC 24V - 1 Amp
Temperature Limit Shut Down:
Compact BLDC: 90°C
Slotless BLDC: 90°C
Time before shut down: 2 Seconds
UART Serial Comm:
Pump speed measurement: ±200 RPM
Internal Motor Temp: ±10°C
Current Measurement: ±50mA
Temp and current limits are factory adjustable
On/Off only, PWM input, and 0-5Vdc are factory set, see ordering table.
Standard on/off configuration only requires DC power and Ground.

BTX-Connect Miniature Diaphragm Pump
Typical Flow Curve

BTX-Connect Single Head
Typical Performance



BTX-Connect Dual Head
Typical Performance



- **Dual head performance shown with B2H configuration and pump heads connected in parallel**
- **Curve shows maximum flow capability with a 0.090" pump offset, which are vacuum or pressure only Pumps capable of alternating pressure and vacuum are available with 0.050" pump offset or less. See ordering table below for a list of available standard options**
- **Detailed performance specification sheets are available for each part number**
- **Contact Parker Precision Fluidics Applications Engineering team for other performance options**

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from a Parker or its subsidiaries or authorized distributor.

The above graphs represent an example of performance for the pump series handling air at 800 feet (244 m) above sea level at 75 degree F (24 C). Performance will vary depending on barometric pressure and media temperature. A variety of configurations can be accommodated to meet application requirements.

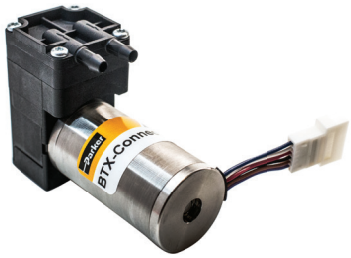
Curves are representative of standard pump configurations. Pump configurations could be customized for higher or lower flows depending on specific customer requirements.

Please contact Parker Precision Fluidics Applications Engineering for other considerations.

BTX-Connect Miniature Diaphragm Pump
Sizing and Selection

BTX-Connect Single Head
Compact BLDC Motor
B1C

BTX-Connect Single Head
Slotless BLDC Motor
B1S



BTX-Connect Dual Head
Compact BLDC Motor
B2C

BTX-Connect Dual Head
Slotless BLDC Motor
B2S

BTX-Connect Dual Head
High Performance Slotless
BLDC Motor
B2H

Efficiency	Better	Best	Best
Flow Rate	Good	Better	Best
Life	Best - 15,000 Hours	Best - 15,000 Hours	Best - 15,000 Hours
Control	On/Off, Digital, PWM, 0-5V	On/Off, Digital, PWM, 0-5V	On/Off, Digital, PWM, 0-5V
Protection	Reverse Polarity, Temp, Current	Reverse Polarity, Temp, Current	Reverse Polarity, Temp, Current
Cost	Better	Good	Good

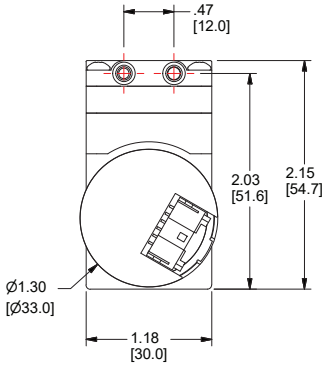
Mounting Guidelines:

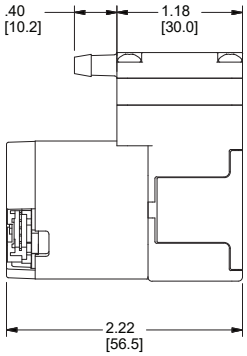
- Bracket options available for mounting consideration (*See EZ Mount catalog pages).*
- Hole in the center of the bottom housing is for manufacturing only—not to be used for mounting.
- Mounting holes are drilled for #6-20 self-tapping screws with 1/4" (6 mm) thread engagement torque to 4 in-lbs (0.45 N-m).

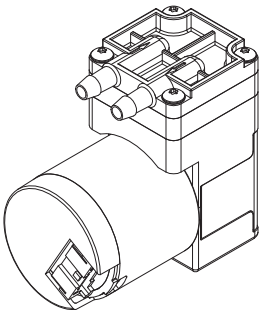
Port Connections:

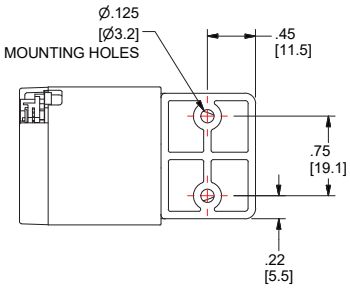
- Barbs are sized for 1/8" (3 mm) ID tubing, 70-80 durometer recommended.
- Flow direction is marked on the pump head with arrows.

BTX-Connect Miniature Diaphragm Pump
Mechanical Drawings



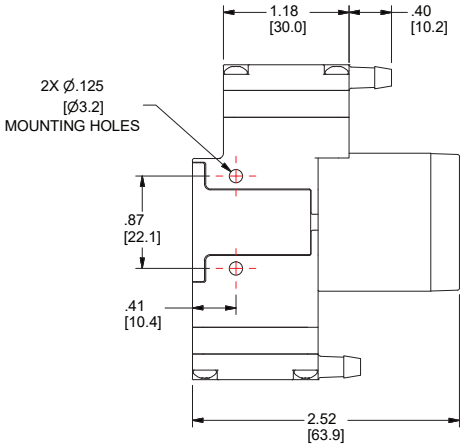


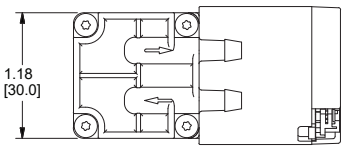


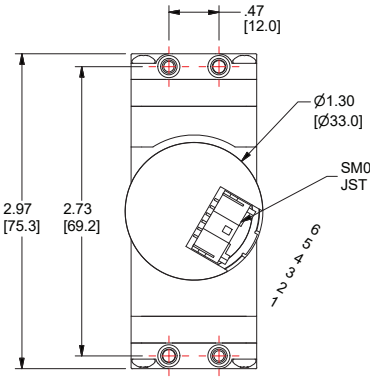


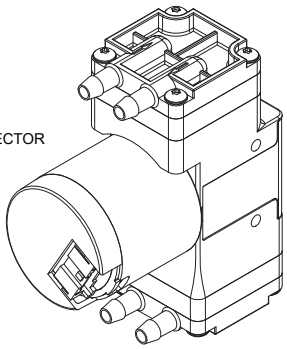
NOTES:
MOUNTING HOLES ARE DRILLED FOR
#6-20 SELF-TAPPING SCREWS WITH
1/4" THREAD ENGAGEMENT.
[torque to 4 in-lbs.]

UNITS
IN [mm]









UNITS
IN [mm]

PIN OUT	
1	TACH
2	PWM / EVC
3	V+
4	GROUND
5	UART Rx
6	UART Tx

NOTES:
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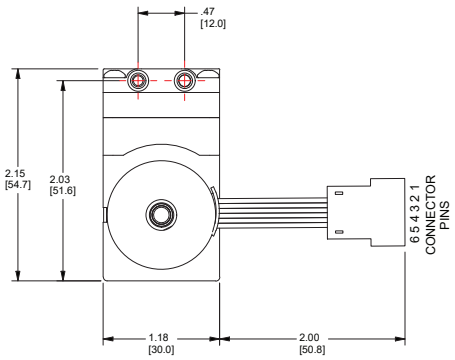
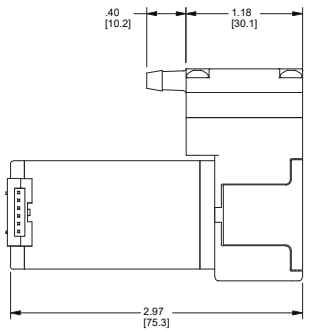
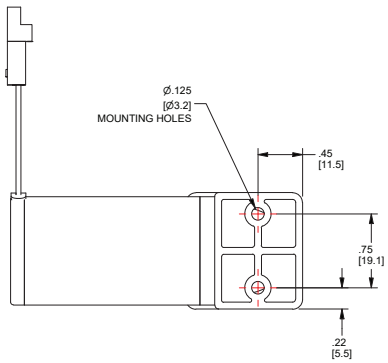
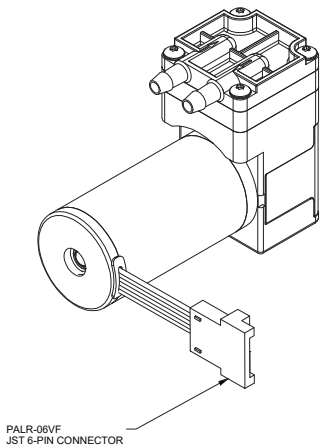
#6-20 SELF-TAPPING SCREWS WITH
1/4" THREAD ENGAGEMENT.
[torque to 4 in-lbs.]

BTX-Connect Miniature Diaphragm Pump
Mechanical Drawings



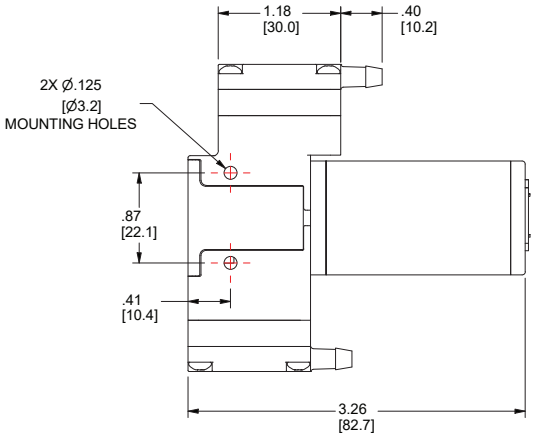


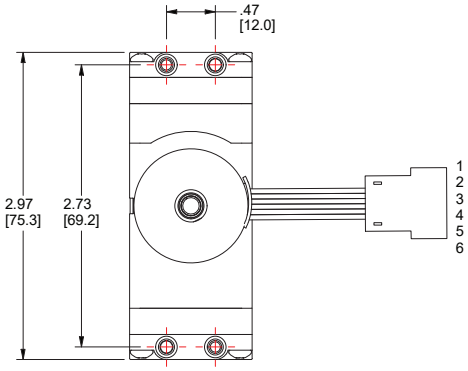


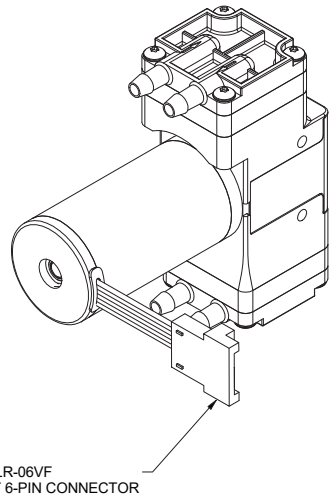


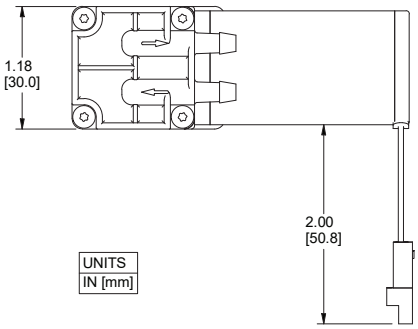
NOTES:
MOUNTING HOLES ARE DRILLED FOR
#6-20 SELF-TAPPING SCREWS WITH
1/4" THREAD ENGAGEMENT.
[torque to 4 in-lbs.]

UNITS
IN [mm]









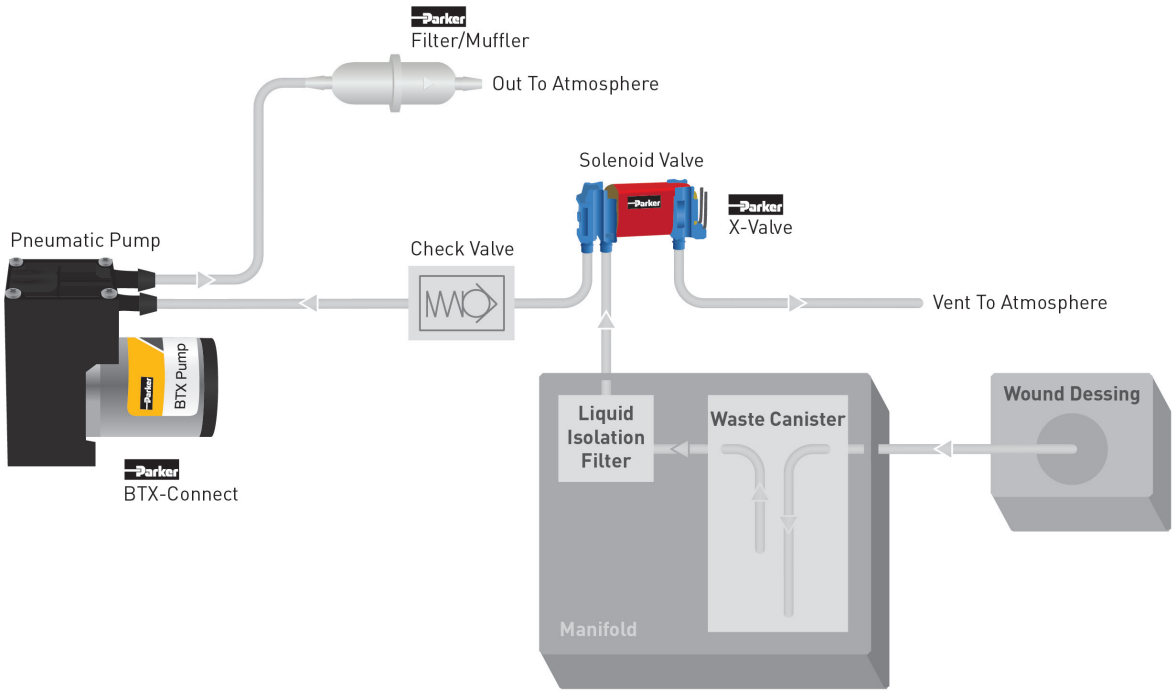
UNITS
IN [mm]

PIN OUT	
1	TACH
2	PWM / EVC
3	V+
4	GROUND
5	UART Rx
6	UART Tx

NOTES:
MOUNTING HOLES ARE DRILLED FOR
#6-20 SELF-TAPPING SCREWS WITH
1/4" THREAD ENGAGEMENT.
[torque to 4 in-lbs.]

BTX-Connect Miniature Diaphragm Pump
Typical Flow Diagrams

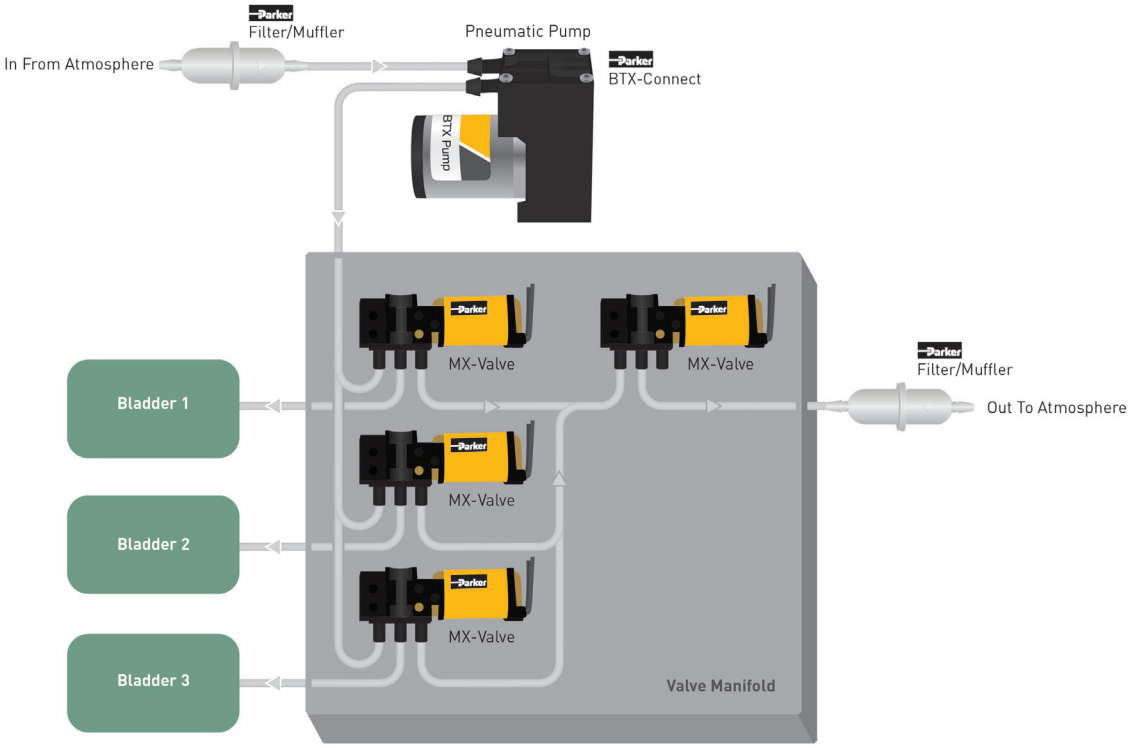
Negative Pressure Wound Therapy (NPWT)



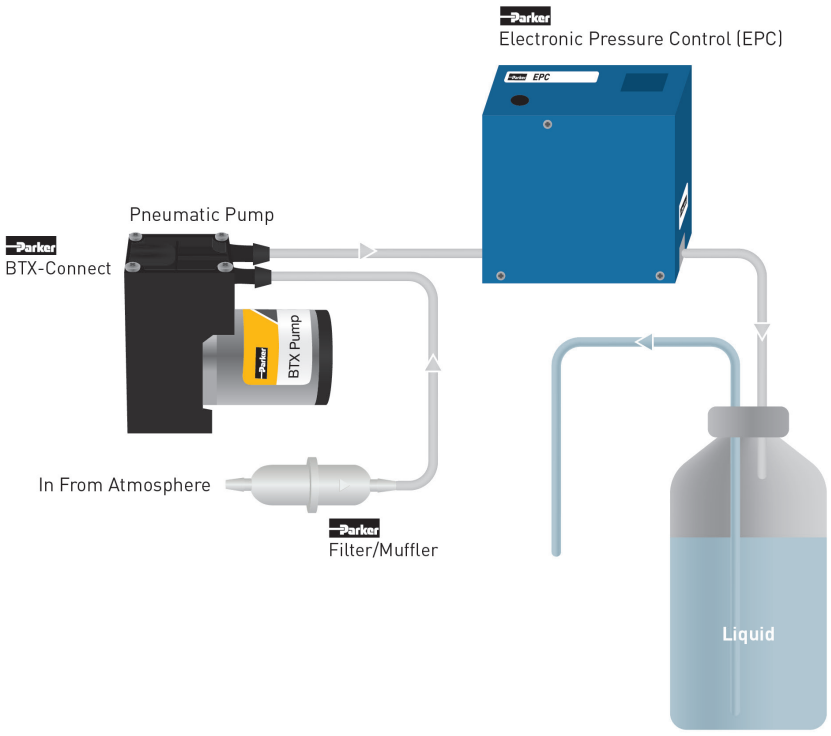
BTX-Connect Miniature Diaphragm Pump

Typical Flow Diagram

Compression Therapy Prevention (DVT)



Air-Over-Liquid Flow Control



BTX-Connect Miniature Diaphragm Pump
CE Compliant

Test	Standard	Test Level
Radiated Emissions	IEC 60601-1-2:2014 EN 61000-6-3:2007/A1:2011	Class B
DC Mains Conducted Emissions	IEC 60601-1-2:2014	Class B
ESD	IEC 60601-1-2:2014 EN 61000-4-2	+/- 8kV couplings planes +/- 8kV contact, +/- 15kV air
RFI - Amplitude Modulated	IEC 60601-1-2:2014 EN 61000-4-3	80-2700 MHz @ 3V/m 1kHz 80%AM
Proximity fields from RF wireless communication	IEC 60601-1-2:2014 EN 61000-4-3	Full table of tested conditions available in the lab report
Power-Frequency Magnetic Filed	IEC 60601-1-2:2014 EN 61000-4-8	30A/m

Electrical Integration and Motor Control

Motor Electrical Connection

Integrated Electrical Connector	Male pin JST PALR - 06VF
Recommended Mating Connector	Manufacturing: JST Housing Part Number: PAP-06V-S Terminal Part Number: SPHD-001T-P0.5
Recommended Wire	22 AWG Stranded Wire

BTX- Connect Motor Control Options

The motor control feature is factory selected in 4 speed control modes: On/Off control, PWM input, 0-5Vdc input or UART Serial port mode. These modes are described in detail in the Application Notes section. The Tachometer signal is always enabled.
*The controller utilizes the on-board micro-controller clock, it is not a real time clock.

Speed Control Methods

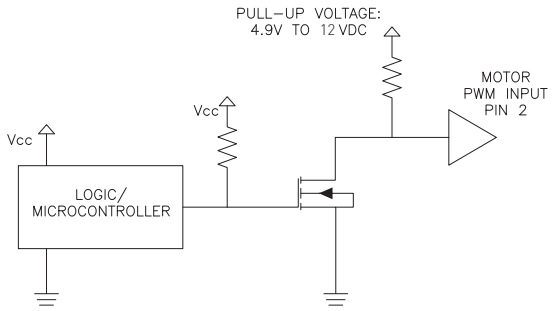
Stored Speed Setting	With this configuration, the pump speed is factory set, only ground and input voltage must be supplied. The speed can only be adjusted using UART command with this mode.
PWM Input	A PWM signal input is provided on the speed input to change pump speed. When using this mode, the pump is set to 100% speed if the input is floating.
Analog 0-5Vdc Control	0-5 Volt DC signal is applied to control speed. When using this mode, the pump is set to 0% speed if the input is floating.
UART Control	The user will activate the pump and adjust the speed of the pump using the UART serial port channel, the pump will be off until the host sends a UART speed command.

BTX-Connect Miniature Diaphragm Pump
Electrical Integration and Motor Control

PWM Control Electrical Details

On Board Motor Circuit	1k Ω to +5VDC weak pull-up enabled on micro controller (Approximately 150-200 microAmp)5.1VDC Zener diode limits voltage to micro-controller. Controller measures 10 samples 5ms apart to filter input signal. (50ms time between speed updates)
User Control Circuit	User must pull the 5 VDC signal to ground, 0.8 VDC low threshold. MOSFET transistor circuit with external pull-up resistor is recommended as shown in example below.
Control Range	0-95% duty cycle. 96-100% will operate motor at full speed Recommended to only supply PWM signal of 0-95% for speed control.

User PWM Control Circuit Example



0-5VDC Control Electrical Details

On Board Motor Circuit	1k Ω to micro controller analog input. 5.1VDC Zener diode limits voltage to micro-controller. If the input is disconnected (floating input) it is normal for the pump to operate very slowly, less than 100 RPM or completely off. Controller measures 10 samples 5ms apart to filter input signal. (50ms time between speed updates)
User Control Circuit	User must supply 0 to 5 VDC analog signal for control

Tachometer Electrical Details

Speed Signal Output	The feature is always on, regardless of speed control mode
Compact BLDC Signal	4 Pulses per rotation of the pump
Slotless BLDC Signal	1Pulse per rotation of the pump
On Board Motor Circuit	0 to 5 VDC square wave signal Low signal will be < 0.6VDC, High will be > 4.3VDC

Do not connect motor electrical connector harness while power is applied (Hot Plugging).
Arching in the connector may damage UART electronics.

BTX-Connect Miniature Diaphragm Pump
Application Notes

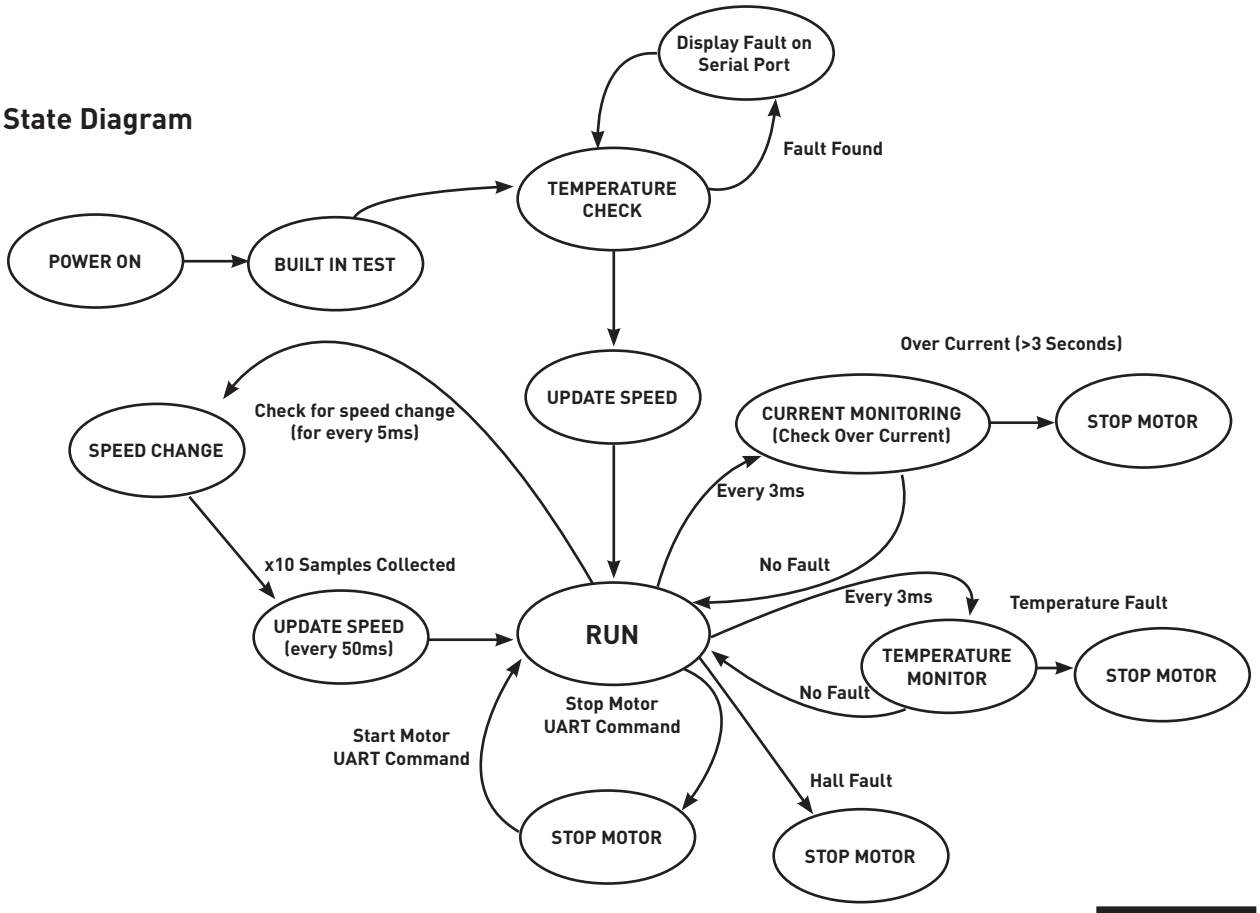
UART Electrical Details

UART Voltage	5Vdc TTL UART Voltage
On Board Motor Circuit	UART Connection to PIC18F micro-controller
User Control Circuit	Recommended to use isolation, such as optocouplers motor electronics from user electronics. Parker uses a Microchip MCP2200 UART to USB transceiver IC and confirms it is compatible with the BTX-Connect Motor.
Power Supply and Ground Recommendations	It is possible to power the motor micro-controller through the UART Rx pin. Care should be taken to avoid this possibility. If voltage is provided to the Motor Rx pin while Ground is connected and Vin is disconnected the internal micro-controller may be parasitically powered. This is due to current flowing through the internal Schottky protection diodes in the micro-controller. This can cause the micro-controller to stay powered on when the power is cycled, or it may cause the micro-controller to enter a brown-out condition. It is recommended to remove power from the Rx pin in this condition or low-side switch the Ground to the pump.

Connect Features and Instructions

The BTX-Connect offers many methods to control the pump, this is configured by the factory. However, in any configuration, the serial UART port can be accessed for pump information.

State Diagram



BTX-Connect Miniature Diaphragm Pump
Serial UART Details

The BTX with Connect technology includes a UART Serial port that is available regardless of speed control mode. Communication with the pump allows a user to monitor pump performance and pump health. This provides more detail to the hosts system for more integrated pump management and error handling.

UART Configuration

Electrical Signal	**5Vdc TTL Level***
Baud Rate	**9600 bps**
Data Bits	**8**
Parity	**None**
Stop Bits	**1**
Flow Control	**None**
Timing	**Allow>20ms delay between messages**

***For integration with RS232 or USB, a transceiver/converter is required**

UART Syntax

1 Byte	4 Bytes	1 Byte	4 Bytes	1 Byte
$	**GETS**	**,**	**TACH**	**#**
Starting Flag	**Command Type**	**Comma Selector**	**Command**	**Ending Flag**

1 Byte	4 Bytes	1 Byte	4 Bytes	1 Byte	1-5 Bytes	1 Byte
$	**CMDS**	**,**	**PWMS**	**,**	**75**	**#**
Starting Flag	**Command Type**	**Comma Selector**	**Parameter Name**	**Comma Separator**	**Input Parameter**	**Ending Flag**

***Each message from the motor will end with a carriage return (ASCII: 0D)**

UART Command Set	**Command Sent to Motor**	**Response from Motor**	**Description**
Temperature Fault at Start-Up	No Command Required; Only at pump startup	$Temperature Fault: xxx#	If the motor controller temperature exceeds the allowed limit, the pump will not start. This is continuously monitored until the fault is cleared and the motor will start. The pump will continuously send this response until the fault is cleared.
Pump Heartbeat Message	No Command Required	$HB#	Pump will report a heartbeat message over UART every 30 seconds
Invalid Message Response	Incorrect Command or Syntax	$CMD: Error#	Response if an incomplete message is sent to the pump
Control Commands	**Command Sent to Motor**	**Response from Motor**	**Description**
Set Pump Speed	$CMDS,PWMS,500#	$ACK,PWMS,500#	Set PWM Duty Cycle, <1-100%>, 505 = 50.5% 1000 = 100.0%
Stop Pump	$CMDS,MSTP#	$ACK,MSTP#	Motor will stop
Restart Pump	$CMDS,MRST#	$ACK,MRST#	Pump will restart, will allow restart fault

BTX-Connect Miniature Diaphragm Pump
Serial UART Details

Status Commands	Command Sent to Motor	Response from Motor	Description
Read Approx. Current	$GETS,CURR#	$STAT,CURR,1100#	Pump reports approximate average motor current, reported in mA
Read Approx. Temp.	$GETS,TEMP#	$STAT,TEMP,50#	Pump reports approximate temperature on motor controller, reported in Celsius
Read Pump Speed	$GETS,TACH#	$STAT,TACH,3200#	Pump reports approximate pump speed in RPM (integer value 0 - 65530)
Read Set PWM Duty	$GETS,SDTY#	$STAT,SDTY,50#	Pump will report output duty cycle (regardless of control method) (integer value 0 - 1000), 505 = 50.5% 1000 = 100.0%
Read Pump Health	$GETS,HLTH#	$STAT,HLTH,Normal#	Pump will report "Normal" if no fault has occurred
		$STAT,HLTH,OverCurrent#	Pump will report "Over Current" if preset current limit has been reached and pump has stopped
		#STAT,HLTH,OverTemperature#	Pump will report "OverTemperature" if preset temperature limit has been reached and pump has stopped
		$STAT,HLTH,UnknownHallState#	Pump will report "UnknownHallState" if the hall pattern detected is undefined, for example this may occur if a hall sensor has failed

History Command	Command Sent to Motor	Response from Motor	Description
Read Pump History	$GETP,HIST#	$STAT,CRED,xxx#	Pump will report the number of times a current fault has occurred (integer value 0 - 255)
		$STAT,TRED,xxx#	Pump will report the number of times a temperature fault has occurred (integer value 0 - 255)
		$STAT,HOUR,xxxxx#	Pump will report number of operating hours for the pump (integer value 0 - 22500); approximate accuracy for comparison use Pump stores time in increments of 10 seconds, upon start-up a 10 second increment is immediately stored (frequent on/off will effect time accumulation). Due to limitations with flash storage read/writes, this value is capped at 22,500 hours.
		$STAT,CYCL,xxxxxxx#	Pump will report number of on/off power cycles for the pump (integer value 0 - 1500000) This value is capped at 1.5 Million cycles.

BTX-Connect Miniature Diaphragm Pump
Application Notes
Chemical Compatibility Chart*

BTX-Connect	Chemical Compatibility of Wetted Path Materials	
Chemical	AEPDM	PBT
Air	1	1
Ozone (1000 ppm)	1	1
Oxygen	1	1
Ethylene (Ethene)	1	1
Methane	4	2
Nitrogen	1	1
Carbon Dioxide	2	1
Acetone (Vapor/Cleaning)	1	1(5%), 3(100%)

*The above is an Abbreviated Chemical Compatibility Chart. Please consult factory for details.

Compatibility Legend

1. EXCELLENT
   Minimal or no effect
2. GOOD
   Possible swelling and/or loss of physical properties
3. LIMITED
   Moderate or severe swelling and loss of physical properties
4. NOT RECOMMENDED
   Severe effect and should not be considered

Note: Consult factory for other gases.

Pulse Width Modulation (PWM)

Pulse-width modulation is a commonly used technique for controlling DC motors.

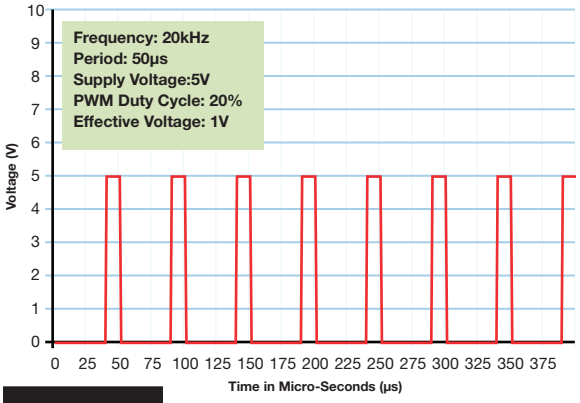
The average value of the voltage fed to the motor is controlled by turning a switch between the voltage supply and the motor on-and-off at a fast pace. The longer the switch is on compared to the off time, the higher the power supplied to the motor.

The PWM switching frequency varies for different types of devices, and is selected based on how it affects the device. For example, some applications require a faster switching frequency to prevent audible noise or electrical noise.

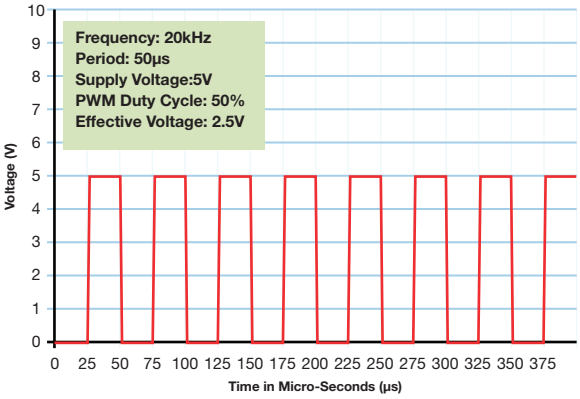
The term duty cycle describes the ratio of on-time to the period (one complete on-and-off cycle). Duty cycle is normally expressed as a percentage of on-time, 100% being full-power and 50% being half-power.

The advantage of PWM is the reduction of power-loss due to switching versus other control methods. Parker Hannifin recommends controlling the pump using 15kHz - 20 kHz frequency range.

20% PWM Example

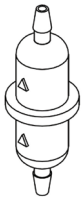


50% PWM Example

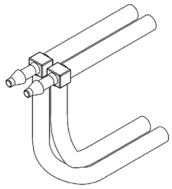


BTX-Connect Miniature Diaphragm Pump
Accessories Information

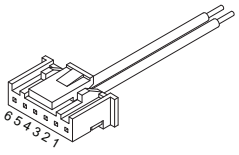
A Filter-Muffler is always recommended in the air inlet or outlet to reduce noise and risk of debris that may affect pump performance.
Parker recommends 40 micron or better filtration to be used with this pump series.



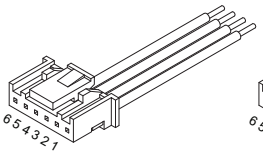
P/N: 00492-15
(10 micron Filter)



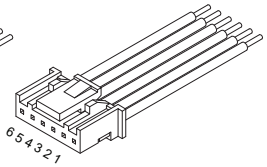
P/N: 01881-KT
(Parallel Tubing)



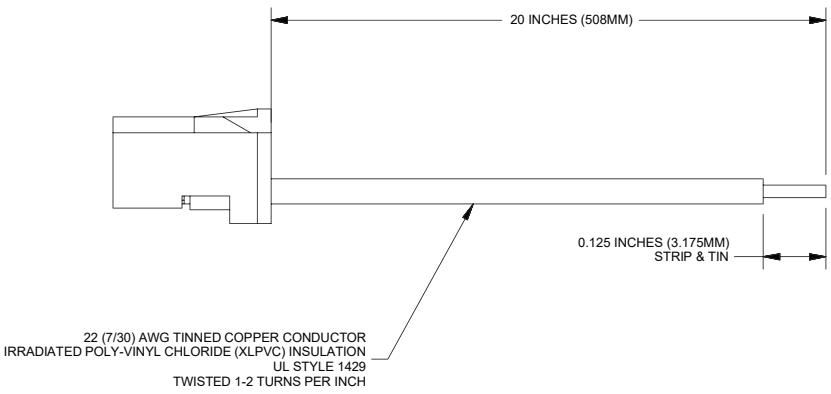
P/N: 02040-10
(2-Wire Harness)



P/N: 02042-10
(4-Wire Harness)



P/N: 02043-10
(6-Wire Harness)

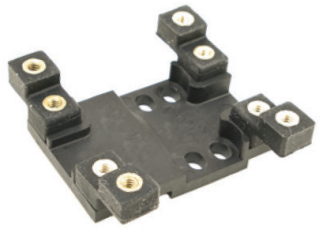


Connector Pin-out

	Color	Function
1	Blue	Tachometer
2	White	Speed Input
3	Red	Power V+
4	Black	Ground V-
5	Brown	UART Rx
6	Violet	UART Tx

BTX-Connect Miniature Diaphragm Pump

EZ Mount available



EZ Mount provides ease of installation and effective control of vibration transfer. EZ Mount was designed to mount easily to the Precision Fluidic BTX Family of diaphragm pumps.

Features

Isolation feet on the EZ mount can be rotated in any one of three ninety-degree planes and is designed for top-down or bottom-up mounting providing simple installation.

EZ Mount was designed to minimize weight added to the pump assembly. Approximate weight is: 0.63 oz (18 g).

Effectively absorbs vibration to minimize most vibration-induced noise and vibration transfer into an instrument.

Designed to keep height and size to a minimum.

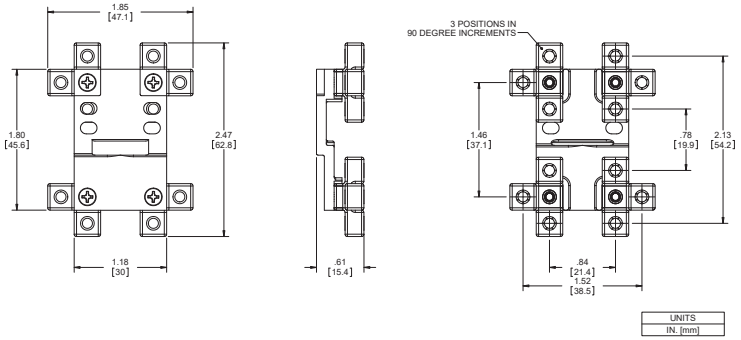
All necessary hardware to attach to a BTX pump is included.

Physical Properties

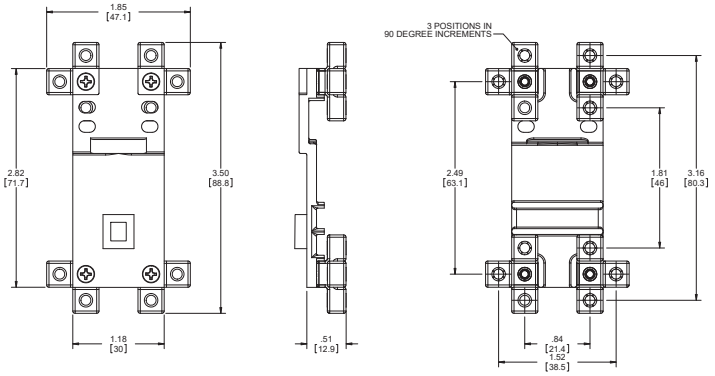
Operating Environment:
41 - 158°F (5 - 70°C)
Humidity:
0 - 95% Relative Humidity
Base Plate:
Noryl GTX830
Feet:
Silicone
Feet Insert:
Brass
Hardware:
Zinc-Plated Steel

Isolation Feet are available in either threaded or thru-hole clearance for standard #4-40 or #6-32 (M3 for clearance hole only).

Style A Dimensions



Style B Dimensions



EZ Mount for BTX with Compact Motor Single and Dual Head (B1C and B2C)

Part Number	Style	Feet Type
00328-10-A45S	A	#4-40 Threaded
00328-10-B45S	A	#4 Clearance
00328-10-D45S	A	#6-32 Threaded
00328-10-C45S	A	#6 / M3 Clearance

EZ Mount for BTX with Slotless Single Head (B1S and B1H)

Part Number	Style	Feet Type
01074-10-A45S	B	#4-40 Threaded
01074-10-B45S	B	#4 Clearance
01074-10-D45S	B	#6-32 Threaded
01074-10-C45S	B	#6 / M3 Clearance

EZ Mount for BTX with Slotless Dual Head (B2S and B2H)

Part Number	Style	Feet Type
00329-10-A45S	B	#4-40 Threaded
00329-10-B45S	B	#4 Clearance
00329-10-D45S	B	#6-32 Threaded
00329-10-C45S	B	#6 / M3 Clearance

BTX-Connect Miniature Diaphragm Pump
Ordering Information

Configuration	Voltage	Motor Control	Part Number	-16 inHq -406 mmHg	-12 inHq -305 mmHg	-8 inHq -203 mmHg	-4 inHq -102 mmHg	0 Free Flow	4 PSIg 276 mbar	8 PSIg 552 mbar	12 PSIg 827 mbar	16 PSIg 1103 mbar
B1C	12	On/Off	B1C-050F12AN-00	0.4	1.1	1.8	2.5	3.3	2.7	2.1	1.6	1.1
BTX-Connect Single Head with Compact BLDC	12	PWM	B1C-050F12AN-03	0.4	1.1	1.8	2.5	3.3	2.7	2.1	1.6	1.1
	24	On/Off	B1C-050F24AN-00	0.4	1.1	1.8	2.5	3.3	2.7	2.1	1.6	1.1
	24	PWM	B1C-050F24AN-03	0.4	1.1	1.8	2.5	3.3	2.7	2.1	1.6	1.1
	12	On/Off	B1C-070P12AN-00	-	-	-	-	4.5	3.5	2.7	2.0	1.2
	12	0-5Vdc	B1C-070P12AN-02	-	-	-	-	4.3	3.1	2.5	1.8	1.2
	12	On/Off	B1C-090P12AN-00	-	-	-	-	5.5	4.5	3.5	2.8	2.2
	12	PWM	B1C-090P12AN-03	-	-	-	-	5.5	4.5	3.5	2.8	2.2
	24	On/Off	B1C-090P24AN-00	-	-	-	-	5.5	4.5	3.5	2.8	2.2
	24	0-5Vdc	B1C-090P24AN-02					6.1	4.9	4.0	3.2	2.5
	12	On/Off	B1C-090V12AN-00	1.5	2.5	3.5	4.7	5.8	-	-	-	-
	12	0-5Vdc	B1C-090V12AN-02	1.2	2	3	4.1	5.2	-	-	-	-
	12	PWM	B1C-090V12AN-03	1.5	2.5	3.5	4.7	5.8	-	-	-	-
	24	On/Off	B1C-090V24AN-00	1.5	2.5	3.5	4.7	5.8	-	-	-	-
	24	PWM	B1C-090V24AN-03	1.5	2.5	3.5	4.7	5.8	-	-	-	-
B1S	12	On/Off	B1S-090P12AN-00	-	-	-	-	4.8	3.9	3.1	2.5	2.0
BTX-Connect Single Head with Slotless BLDC	24	On/Off	B1S-090P24AN-00	-	-	-	-	4.8	3.9	3.1	2.5	2.0
												
B2C	12	On/Off	B2C-050F12AN-00	0.4	1.7	2.6	3.8	5.1	4	3.2	2.3	1.1
BTX-Connect Dual Head with Compact BLDC	12	PWM	B2C-050F12AN-03	0.4	1.7	2.6	3.8	5.1	4	3.2	2.3	1.1
	24	On/Off	B2C-050F24AN-00	0.4	1.7	2.6	3.8	5.1	4	3.2	2.3	1.1
	24	PWM	B2C-050F24AN-03	0.4	1.7	2.6	3.8	5.1	4	3.2	2.3	1.1
	12	On/Off	B2C-070P12AN-00	-	-	-	-	8.2	6	4.4	3.0	2.0
	12	On/Off	B2C-090V12AN-00	2.2	3.5	5.4	7.5	9.5	-	-	-	-
	12	PWM	B2C-090V12AN-03	2.2	3.5	5.4	7.5	9.5	-	-	-	-

BTX-Connect Miniature Diaphragm Pump
Ordering Information

Configuration	Voltage	Motor Control	Part Number	-16 inHq -406 mmHg	-12 inHq -305 mmHg	-8 inHq -203 mmHg	-4 inHq -102 mmHg	0 Free Flow	4 PSIg 276 mbar	8 PSIg 552 mbar	12 PSIg 827 mbar	16 PSIg 1103 mbar
B2S	12	On/Off	B2S-050F12AN-00	0.8	1.9	2.9	4.1	5.3	4.3	3.5	2.7	2.0
BTX-Connect Dual Head with Slotless BLDC	24	On/Off	B2S-050F24AN-00	0.8	1.9	2.9	4.1	5.3	4.3	3.5	2.7	2.0
	12	On/Off	B2S-090P12AN-00	-	-	-	-	9.0	7.2	5.7	4.5	3.3
	24	On/Off	B2S-090P24AN-00	-	-	-	-	9.0	7.0	5.7	4.3	3.2
	12	On/Off	B2S-090V12AN-00	2.2	3.8	5.7	7.6	9.3	-	-	-	-
B2H	12	On/Off	B2H-050A12AN-00	1.6	2.9	4.2	5.7	7.2	5.8	4.8	3.9	3.0
BTX-Connect Dual Head with High Performance Slotless BLDC	12	On/Off	B2H-090V12AN-00	2.8	4.6	6.6	8.7	10.5	-	-	-	-
	12	On/Off	B2H-090R12AN-00	-	-	-	-	10.7	8.9	7.3	5.8	4.4

Accessories Ordering Table

Part No.	Description	Comments
02040-10	2 Pin Wire Harness 20" (508mm) Long	2 Pin wire harness for on/off control only
02042-10	4 Pin Wire Harness 20" (508mm) Long	4 Pin wire harness for speed control and tachometer output
02043-10	6 Pin Wire Harness 20" (508mm) Long	6 Pin wire harness required for UART
00492-15	Filter-Muffler	Filter to 10 microns. Not included with pump
01881-KT	Tubing Assembly	As needed for parallel flow. Not included with pump

BTX Part Number Description (see Appendix A comment 9)

B	**1**	**C**	-	**090**	**P**	**12**	**A**	**N**	-	**00**
Model	Pump Heads	Motor Type		Pump Offset	Diaphragm Configuration	Voltage	Material	Tubing		Special
B - BTX	1 - Single Head	C - Compact		050 - 0.050" Offset	F - Universal Pressure & Vacuum	12 - 12 Vdc	A - 80D AEPDM Diaphragm & low noise Valves	N - None		00 - Factory set speed
	2 - Dual Head	S - Slotless		070 - 0.070" Offset	P - Pressure Only	24 - 24 Vdc	B - 80D AEPDM Diaphragm & 80D Valves	P - Parallel (dual head only)		01- Digital UART speed control
		H - High Performance Slotless		090 - 0.090" Offset	V - Vacuum Only			S - Series (dual head only)		02 - Analog 0-5 Vdc
					A - Universal Pressure & Vacuum (High Compression Chamber)					03 - PWM speed control
					R - Pressure Only (High Compression Chamber)					
					Y - Vacuum Only (High Compression Chamber)					

BTX-Connect Miniature Diaphragm Pump
Ordering Information

Please refer to sizing and selection chart for identifying which one will fit your application

To order on-line go to www.parker.com/precisionfluidics/BTX-Connect) to configure your BTX-Connect Pump.

Serviceable – PPF products are designed for use through the rated life and Parker does not sell replacement parts, nor is it recommended to service these in the field

Note: In addition to Parker's innovative and flexible pump designs, we offer applications engineering expertise to our customers in order to configure and recommend the optimal pump for the application. Contact Parker Applications Engineering to discuss and configure alternate pump configurations to meet your specific application requirements. Providing information on the following requirements will assist us in developing an optimal solution for your application:

- Noise
- Operating Pressure / Vacuum
- Power Consumption
- Life Requirement
- Size
- Motor Control
- Media
- Voltage

Parker Hannifin Precision Fluidics Division reserves the right to make changes. Drawings are for reference only.

Appendix A

All performance data is typical based on standard conditions: 70°F and 14.7 psia (21°C and 1 bar).

1. Duty Dependent. For operation above 122°F (50°C) consult factory

2. Noise is dependent on the configuration and operation of the pump in the application. Parker has the ability to tailor the pump configuration when noise is a critical criterion in the effort to meet the performance requirements of the application. Noise level is tested to Parker protocol P-105.

3. Life rating can vary depending on application and operating conditions.

4. Custom motor options available. Custom motors may require a significant application potential. The standard motors can be configured with a special winding to meet a particular operation point at a specified voltage

5. Current range is dependent on motor type, voltage, pressure/vacuum and flow requirement. Lower levels possible depending on application.

6. Inductance is an indicator of induced voltage with change in current and it is a key parameter to enable customers' low energy intrinsic safety systems

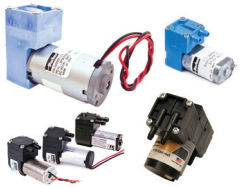
7. Maximum intermittent pressure/vacuum data is a pump capability guideline for applications that go beyond the maximum continuous levels for short periods of time. Please consult customer specific requirements with the factory or Applications Engineering.

8. Pump efficiency is a measure of the flow rate generated per unit of power consumed. Efficiency may change dependent on application and operating condition at free flow.

9. Part number description for reference only, not all configurations are available or configurable. Contact Parker Precision Fluidics Applications Engineering team for other performance options.

BTX-Connect Miniature Diaphragm Pump

Serving a broad spectrum of life science, air quality, and process instrumentation OEM fluidic needs



Providing Pressure and Vacuum:
Broad range of diaphragm pumps for Gas and Liquid

Gas Flow Control:
High to Low Flow Proportional Valves

On/Off & Channel Selection Capabilities:
Gas and Liquid Solenoid Valves

High Precision Thermal Flow Control:
Mass Flow Controllers and Meters

Learn More at: discover.parker.com/BTX-Connect

Below are some common specifications that are helpful to have on hand to accelerate your product selection:

- Gas Type
- Maximum Flow Rate
- Inlet and Outlet Pressures
- Operating Temperature
- Standard Reference Conditions
- Process Connection Size and Type
- Set Point Signal
- Digital Communication Protocol Preferences

For more information call **+1 603 595 1500** or email **ppfinfo@parker.com**

Visit **www.parker.com/precisionfluidics**

BTX-Brush Miniature Diaphragm Pump

Up to 6 LPM Free Flow

Parker's BTX-Brush pump product line combines best in class diaphragm pump design, ultra-low vibration, and advanced manufacturing techniques to bring a next-generation solution to next-generation device needs. The BTX-Brush Pump is designed to provide high performance with superior quality and reliability. The options for Single Head, Dual Head, Pressure only, Vacuum only, and Pressure/Vacuum configurations offer a wide range of solutions with the support of Parker's Global Teams.

Applications

- Point of Care Diagnostics
- Gas Generator
- Compression Therapy
- Water Quality Monitoring
- Patient Monitoring

Features

Low noise dual ball bearing motor design

Optimized pump balancing for ultra-low vibration

Isolation mounts available for simple mounting

RoHS, REACH, and CE compliant

Product Specifications

Physical Properties

Operating Environment[1]:
41 to 122°F (5 to 50°C)
Media:
Air, Nitrogen, Oxygen, and other non-reacting gases
Humidity:
0 - 80% Relative Humidity non-condensing
Pump Assembly Rated Life[3]:
Dual Ball Bearing Brush Motor Up to 3,000 Hours *For life up to 15,000, see BTX-Connect datasheet*
Compact BLDC Single Head
Weight
Single Head 6.8 oz (193 g)
Dual Head 8 oz (226 g)

Pneumatic

Maximum Unrestricted Flow:
Single Head: Up to 5.8 LPM Dual Head: Up to 6.1 LPM
Pressure Range:
Continuous Duty: Up to 20 PSIg (1.4 Bar)
Vacuum Range:
Continuous Duty: Up to -21 inHg (-533 mmHg)
Filtration:
40 microns - recommended

Electrical

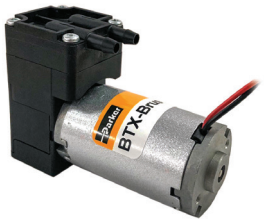
Motor Type (DC):
Dual Ball Bearing, Iron Core Brush
Nominal Motor Voltages[4]:
6, 12, or 24 Vdc
Electrical Termination:
22 AWG Insulated Wire Leads 10 Inch Length (254 mm)

Wetted Materials

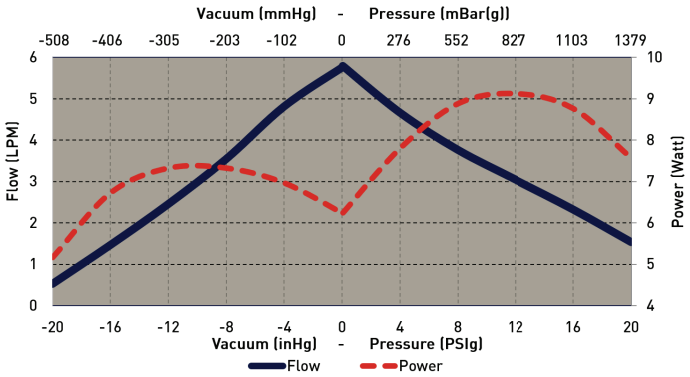
Diaphragm:
Long Life - Advanced EPDM
Valves:
EPDM
Pump Head:
PBT

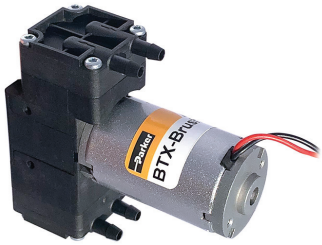
Other materials available upon request

BTX-Brush Miniature Diaphragm Pump
Typical Flow Curve

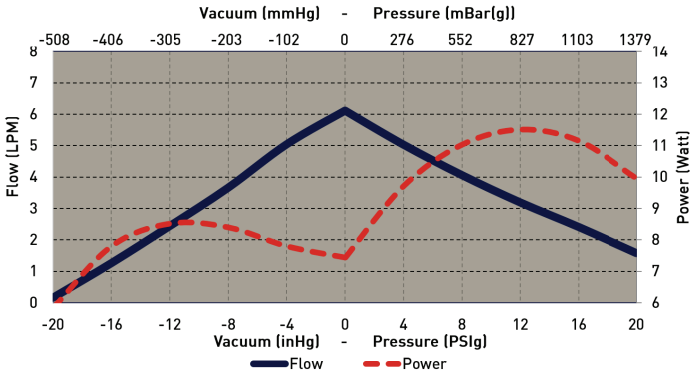


BTX-Brush Single Head
Typical Performance





BTX-Brush Dual Head
Typical Performance



- **Single head curve shows maximum flow capability with a 0.090" pump offset, which are vacuum or pressure only Pumps capable of alternating pressure and vacuum are available with 0.050" pump offset or less. See ordering table below for a list of available standard options**
- **Dual head performance shown with pump heads connected in parallel with 0.050″ pump offset.**
- **Detailed performance specification sheets are available for each part number**
- **Contact Parker Precision Fluidics Applications Engineering team for other performance options**

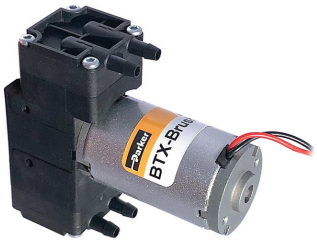
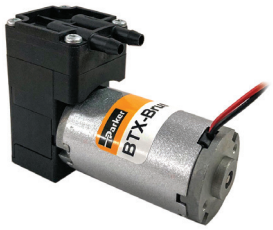
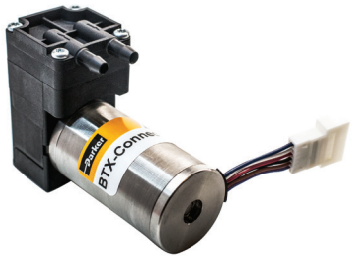
The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from a Parker or its subsidiaries or authorized distributor.

The above graphs represent an example of performance for the pump series handling air at 800 feet (244 m) above sea level at 75 degree F (24 C). Performance will vary depending on barometric pressure and media temperature. A variety of configurations can be accommodated to meet application requirements.

Curves are representative of standard pump configurations. Pump configurations could be customized for higher or lower flows depending on specific customer requirements.

Please contact Parker Precision Fluidics Applications Engineering for other considerations.

BTX-Brush Miniature Diaphragm Pump
BTX Family Selection

BTX-Brush	BTX-Connect	
BTX-Brush Dual Head Dual Ball Bearing Brush Motor **B2B**	BTX-Connect Dual Head Compact BLDC Motor **B2C**	BTX-Connect Dual Head Slotless BLDC Motor **B2S and B2H**
		
BTX-Brush Single Head Dual Ball Bearing Brush Motor **B1B**	BTX-Connect Single Head Compact BLDC Motor **B1C**	BTX-Connect Single Head Slotless BLDC Motor **B1S and B1H**
		

Efficiency	Good	Better	Best
Flow Rate	Up to 6.1 L/min	Up to 9.5 L/min	Up to 11L/Min
Life	Up to 3,000 Hours	>15, 000 Hours	>15, 000 Hours
Control	On/Off, PWM	On/Off, Digital, PWM, 0-5V	On/Off, Digital, PWM, 0-5V
Protection	-	Reverse Polarity, Temp, Current	Reverse Polarity, Temp, Current
Cost	Best	Better	Good

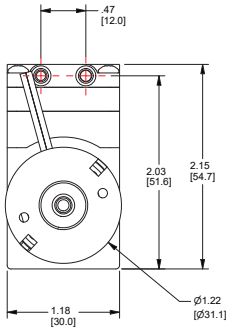
Mounting Guidelines:

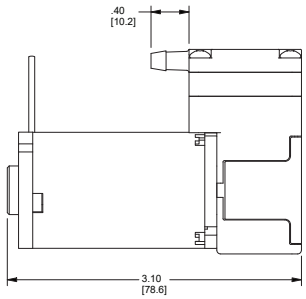
- Bracket options available for mounting consideration (*See EZ Mount catalog pages).*
- Hole in the center of the bottom housing is for manufacturing only—not to be used for mounting.
- Mounting holes are drilled for #6-20 self-tapping screws with 1/4" (6 mm) thread engagement torque to 4 in-lbs (0.45 N-m).

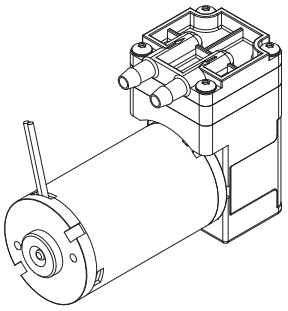
Port Connections:

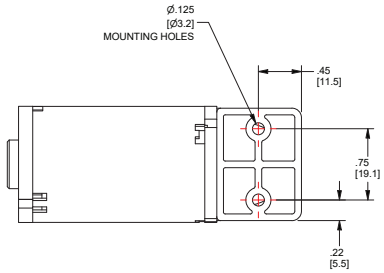
- Barbs are sized for 1/8" (3 mm) ID tubing, 70-80 durometer recommended.
- Flow direction is marked on the pump head with arrows.

BTX-Brush Miniature Diaphragm Pump
Mechanical Drawings



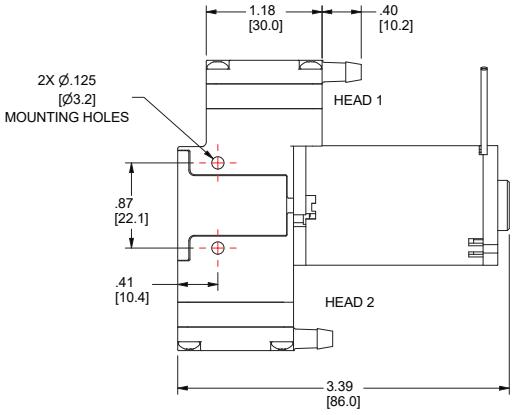


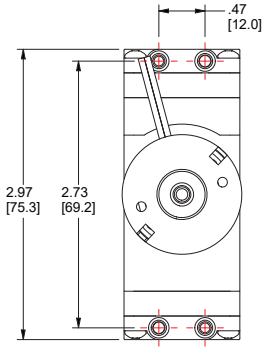


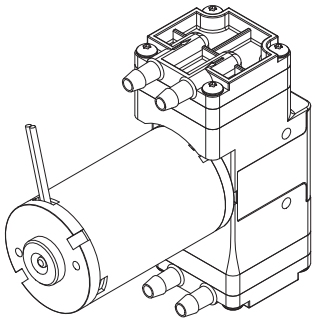


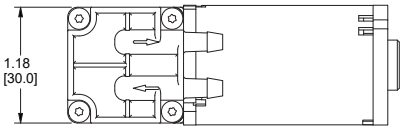
UNITS
IN [mm]

NOTES:
MOUNTING HOLES ARE DRILLED FOR
#6-20 SELF-TAPPING SCREWS WITH
1/4" THREAD ENGAGEMENT.
[torque to 4 in-lbs.]









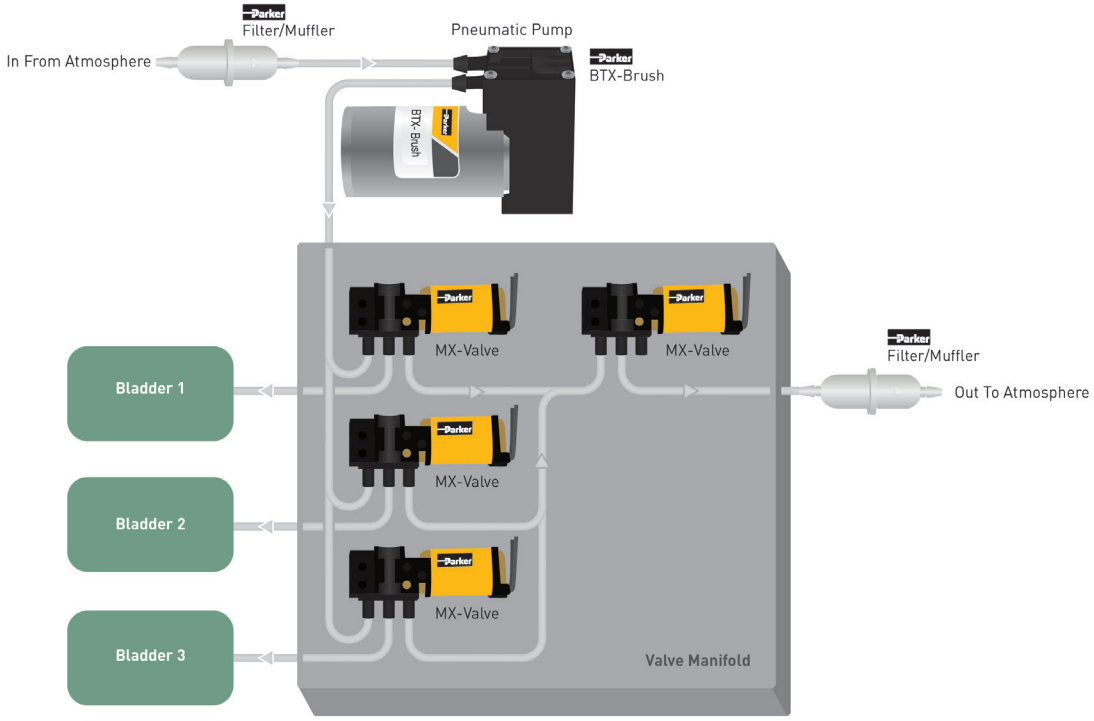
UNITS
IN [mm]

NOTES:
1. MOUNTING HOLES ARE DRILLED FOR
#6-20 SELF-TAPPING SCREWS WITH
1/4" THREAD ENGAGEMENT.
[torque to 4 in-lbs.]

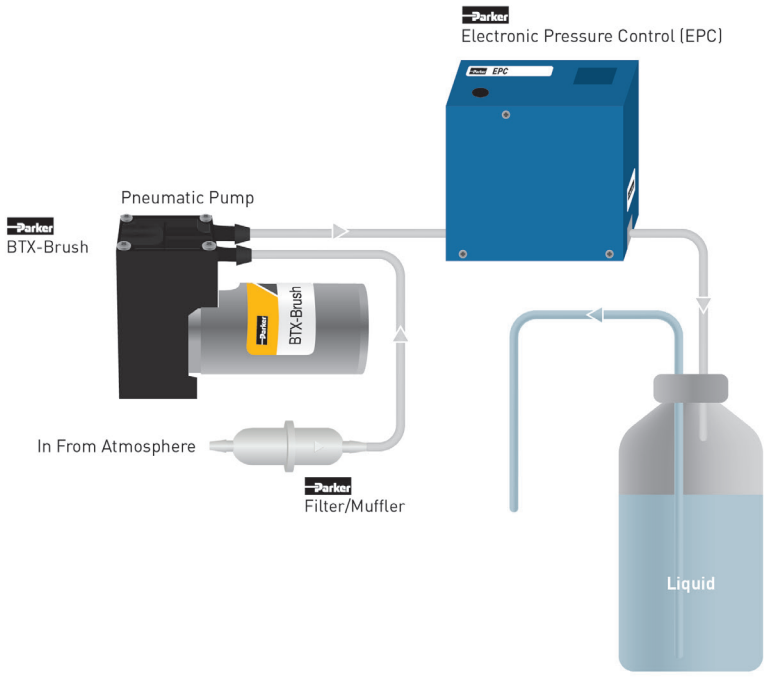
BTX-Brush Miniature Diaphragm Pump

Typical Flow Diagram

Compression Therapy Prevention (DVT)



Air-Over-Liquid Flow Control



BTX-Brush Miniature Diaphragm Pump
Application Notes
Chemical Compatibility Chart*

BTX-Connect	Chemical Compatibility of Wetted Path Materials	
Chemical	AEPDM	PBT
Air	1	1
Ozone (1000 ppm)	1	1
Oxygen	1	1
Ethylene (Ethene)	1	1
Methane	4	2
Nitrogen	1	1
Carbon Dioxide	2	1
Acetone (Vapor/Cleaning)	1	1(5%), 3(100%)

*The above is an Abbreviated Chemical Compatibility Chart. Please consult factory for details.

Compatibility Legend

1. EXCELLENT
   Minimal or no effect
2. GOOD
   Possible swelling and/or loss of physical properties
3. LIMITED
   Moderate or severe swelling and loss of physical properties
4. NOT RECOMMENDED
   Severe effect and should not be considered

Note: Consult factory for other gases.

Pulse Width Modulation (PWM)

Pulse-width modulation is a commonly used technique for controlling DC motors.

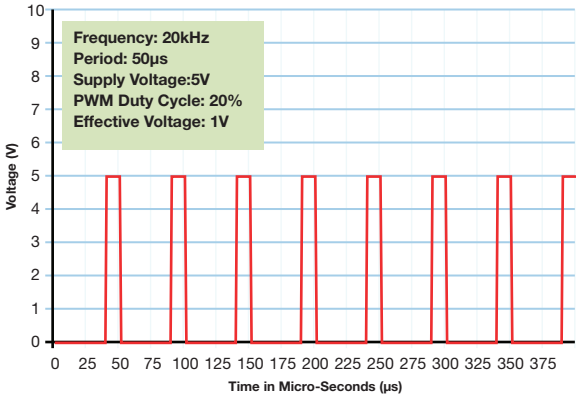
The average value of the voltage fed to the motor is controlled by turning a switch between the voltage supply and the motor on-and-off at a fast pace. The longer the switch is on compared to the off time, the higher the power supplied to the motor.

The PWM switching frequency varies for different types of devices, and is selected based on how it affects the device. For example, some applications require a faster switching frequency to prevent audible noise or electrical noise.

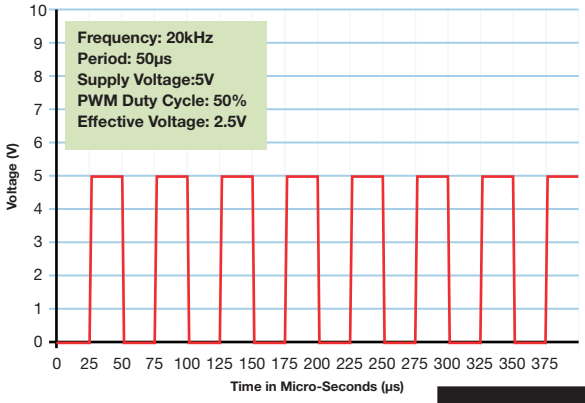
The term duty cycle describes the ratio of on-time to the period (one complete on-and-off cycle). Duty cycle is normally expressed as a percentage of on-time, 100% being full-power and 50% being half-power.

The advantage of PWM is the reduction of power-loss due to switching versus other control methods. Parker Hannifin recommends controlling the pump using 15kHz - 20 kHz frequency range.

20% PWM Example

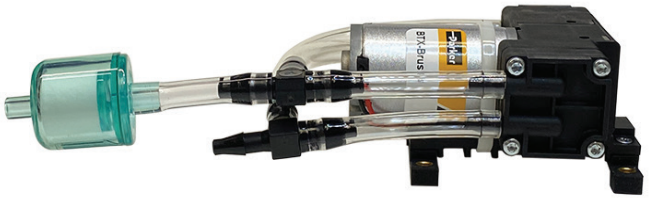


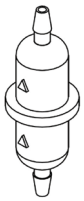
50% PWM Example



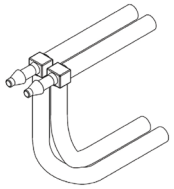
BTX-Brush Miniature Diaphragm Pump
Accessories Information

A Filter-Muffler is always recommended in the air inlet or outlet to reduce noise and risk of debris that may affect pump performance.
Parker recommends 40 micron or better filtration to be used with this pump series.





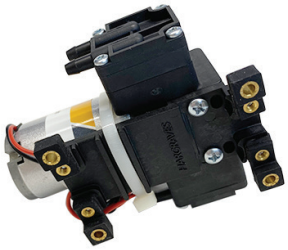
P/N: 00492-15
(10 micron Filter)



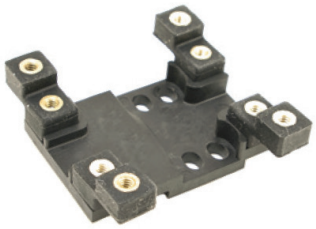
P/N: 01881-KT
(Parallel Tubing)

BTX-Brush Miniature Diaphragm Pump

EZ Mount available



EZ Mount provides ease of installation and effective control of vibration transfer. EZ Mount was designed to mount easily to the Precision Fluidic BTX Family of diaphragm pumps.



Features

Isolation feet on the EZ mount can be rotated in any one of three ninety-degree planes and is designed for top-down or bottom-up mounting providing simple installation.

EZ Mount was designed to minimize weight added to the pump assembly. Approximate weight is: 0.63 oz (18 g).

Effectively absorbs vibration to minimize most vibration-induced noise and vibration transfer into an instrument.

Designed to keep height and size to a minimum.

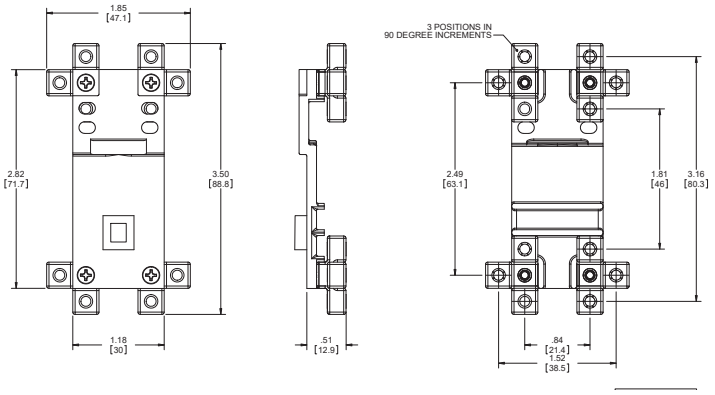
All necessary hardware to attach to a BTX pump is included.

Physical Properties

Operating Environment:
41 - 158°F (5 - 70°C)
Humidity:
0 - 95% Relative Humidity
Base Plate:
Noryl GTX830
Feet:
Silicone
Feet Insert:
Brass
Hardware:
Zinc-Plated Steel

Isolation Feet are available in either threaded or thru-hole clearance for standard #4-40 or #6-32 (M3 for clearance hole only).

Style B Dimensions



EZ Mount for BTX-Brush Single Head (B1B)

Part Number	Style	Feet Type
00329-10-A45S	B	#4-40 Threaded
00329-10-B45S	B	#4 Clearance
00329-10-D45S	B	#6-32 Threaded
00329-10-C45S	B	#6 / M3 Clearance

EZ-Mount for BTX-Brush Dual Head (B2B)

Part Number	Style	Feet Type
00332-10-A45S	B	#4-40 Threaded
00332-10-B45S	B	#4 Clearance
00332-10-D45S	B	#6-32 Threaded
00332-10-C45S	B	#6 / M3 Clearance

BTX-Brush Miniature Diaphragm Pump
Ordering Information

Configuration	Voltage	Part Number	-16 inHq -406 mmHg	-12 inHq -305 mmHg	-8 inHq -203 mmHg	-4 inHq -102 mmHg	0 Free Flow	4 PSIg 276 mbar	8 PSIg 552 mbar	12 PSIg 827 mbar	16 PSIg 1103 mbar
B1B	6	B1B-050A06AN-00	0.9	1.5	2.2	2.9	3.7	3.1	2.6	2.2	1.7
BTX-Brush Single Head	12	B1B-050A12AN-00	0.9	1.5	2.2	2.9	3.6	3.0	2.6	2.2	1.7
	24	B1B-050A24AN-00	0.8	1.4	2.1	2.8	3.6	3.0	2.5	2.1	1.6
	6	B1B-090P06AN-00	-	-	-	-	5.9	4.6	3.7	3.0	2.3
	12	B1B-090P12AN-00	-	-	-	-	5.9	4.6	3.7	3.0	2.3
	24	B1B-090P24AN-00	-	-	-	-	5.7	4.5	3.6	2.9	2.2
	6	B1B-090V06AN-00	1.5	2.5	3.6	4.8	5.7	-	-	-	-
	12	B1B-090V12AN-00	1.5	2.5	3.6	4.8	5.7	-	-	-	-
	24	B1B-090V24AN-00	1.4	2.4	3.5	4.7	5.6	-	-	-	-
B2B	12	B2B-050A12AN-00	1.2	2.4	3.6	5.0	6.1	5.0	4.0	3.2	2.4
BTX-Brush Dual Head											
											

BTX-Brush Miniature Diaphragm Pump
Ordering Information

Accessories Ordering Table

Part No.	Description	Comments
00492-15	Filter-Muffler	Filter to 10 microns. Not included with pump
01881-KT	Tubing Assembly	As needed for parallel flow. Not included with pump

BTX Part Number Description (see Appendix A comment 9)

B	**1**	**B**	-	**090**	**P**	**12**	**A**	**N**	-	**00**
Model	Pump Heads	Motor Type		Pump Offset	Diaphragm Configuration	Voltage	Material	Tubing		Special
B - BTX	1 - Single Head	B - Brush Motor, Dual Ball Bearing		050 - 0.050" Offset	P - Pressure Only	6 - 6 Vdc	A - 80D AEPDM Diaphragm & low noise Valves	N - None		00 - Factory Standard
	2 - Dual Head			090 - 0.090" Offset	V - Vacuum Only	12 - 12 Vdc				
					A - Universal Pressure & Vacuum (High Compression Chamber)					

BTX-Brush Miniature Diaphragm Pump
Ordering Information

Please refer to sizing and selection chart for identifying which one will fit your application

To order on-line go to www.parker.com/precisionfluidics/BTX-Brush) to configure your BTX-Brush Pump.

Serviceable – PPF products are designed for use through the rated life and Parker does not sell replacement parts, nor is it recommended to service these in the field

Note: In addition to Parker's innovative and flexible pump designs, we offer applications engineering expertise to our customers in order to configure and recommend the optimal pump for the application. Contact Parker Applications Engineering to discuss and configure alternate pump configurations to meet your specific application requirements. Providing information on the following requirements will assist us in developing an optimal solution for your application:

- Noise
- Operating Pressure / Vacuum
- Power Consumption
- Life Requirement
- Size
- Motor Control
- Media
- Voltage

Parker Hannifin Precision Fluidics Division reserves the right to make changes. Drawings are for reference only.

Appendix A

All performance data is typical based on standard conditions: 70°F and 14.7 psia (21°C and 1 bar).

1. Duty Dependent. For operation above 122°F (50°C) consult factory

2. Noise is dependent on the configuration and operation of the pump in the application. Parker has the ability to tailor the pump configuration when noise is a critical criterion in the effort to meet the performance requirements of the application. Noise level is tested to Parker protocol P-105.

3. Life rating can vary depending on application and operating conditions.

4. Custom motor options available. Custom motors may require a significant application potential. The standard motors can be configured with a special winding to meet a particular operation point at a specified voltage

5. Current range is dependent on motor type, voltage, pressure/vacuum and flow requirement. Lower levels possible depending on application.

6. Inductance is an indicator of induced voltage with change in current and it is a key parameter to enable customers' low energy intrinsic safety systems

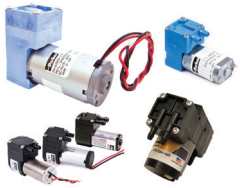
7. Maximum intermittent pressure/vacuum data is a pump capability guideline for applications that go beyond the maximum continuous levels for short periods of time. Please consult customer specific requirements with the factory or Applications Engineering.

8. Pump efficiency is a measure of the flow rate generated per unit of power consumed. Efficiency may change dependent on application and operating condition at free flow.

9. Part number description for reference only, not all configurations are available or configurable. Contact Parker Precision Fluidics Applications Engineering team for other performance options.

BTX-Brush Miniature Diaphragm Pump

Serving a broad spectrum of life science, air quality, and process instrumentation OEM fluidic needs



Providing Pressure and Vacuum:
Broad range of diaphragm pumps for Gas and Liquid

Gas Flow Control:
High to Low Flow Proportional Valves

On/Off & Channel Selection Capabilities:
Gas and Liquid Solenoid Valves

High Precision Thermal Flow Control:
Mass Flow Controllers and Meters

Below are some common specifications that are helpful to have on hand to accelerate your product selection:

- Gas Type
- Maximum Flow Rate
- Inlet and Outlet Pressures
- Operating Temperature
- Standard Reference Conditions
- Process Connection Size and Type
- Set Point Signal
- Digital Communication Protocol Preferences

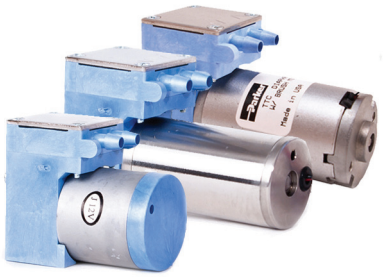
For more information call **+1 603 595 1500** or email **ppfinfo@parker.com**

Visit **www.parker.com/precisionfluidics**

TTC Series

Up to 6 LPM Free Flow

Miniature Diaphragm Pumps (air/gas)



TTC Miniature Diaphragm Pumps are a series of brush and brushless DC motor driven pumps, which are tailored to meet specific application performance requirements. An innovative compact design incorporates leading edge technologies that allow them to operate more efficiently than existing pump designs. TTC Pumps offer multiple component configurations for use in either vacuum, pressure, or alternating vacuum and pressure operations. TTC Series is best for compact and low pressure applications that require high efficiency.

Applications

- Gas Analysis
- Anesthesia Monitors
- Compression Therapy
- CO_2 Monitors
- Wound Therapy
- Trace Detection
- Medical/Training Mannequins
- Degassing

Features

- TTC Series' innovative and efficient design pushes the performance envelope in a lightweight, compact size which allows it to operate at the highest performance/size ratio.
- Highest efficiency in class. The TTC supports low power for portable and battery powered instruments.
- Using our proprietary advanced diaphragm elastomer and superior brushless motor design sets the highest benchmark for service-free operation that exceeds 10,000 hours.
- Incorporating the lightweight EZ Mount accessory facilitates simple system assembly while dampening vibration and reducing noise levels.
- RoHS compliant.

Product Specifications*

Physical Properties

Operating Environment[1]:
41 to 122°F (5 to 50°C)
Storage Environment:
-4 to 212°F (-20 to 100°C)
Media:
Air, Argon, Helium, Nitrogen, Oxygen, and other non-reacting gases
Humidity:
0 – 80% Relative Humidity
Noise Level[2]:
As low as 45 dB @ 12 in (30 cm)
Muffler recommended for additional noise reduction (see accessories)
Pump Assembly Rated Life[3]:
PMDC Iron Core Brush - 3,000 hrs
Brushless Slotted - 10,000 hrs
Brushless Slotless - 10,000 hrs
Weight:
7.2 oz. (206 g) PMDC Iron Core Brush
5.0 oz. (142 g) Brushless Slotted
7.7 oz. (218 g) Brushless Slotless

Electrical

Motor Type (DC):
PMDC Iron Core Brush, Brushless Slotted, Brushless Slotless
Nominal Motor Voltages[4]:
6, 12, or 24 VDC
Other voltages available upon request
Electrical Termination:
PMDC Iron Core Brush - 22 AWG Wire Leads, Length 10" (254 mm)
Brushless Slotted Motor - 22 AWG Wire Leads, Length 20" (508 mm)
Brushless Slotless - 22 AWG Wire Leads, Length 20" (508 mm)
Current Range[5]:
300-800 mA

Pneumatic

Head Configuration:
Single
Maximum Unrestricted Flow:
6 LPM
Pressure Range:
0 - 10 psig (0 - 0.7 bar)
Vacuum Range:
0 - 16 in Hg (0 - 406 mm Hg)
Filtration:
40 microns - recommended
Efficiency at Free Flow[6]
PMDC Iron Core Brush: 0.8 LPM/Watt (*PN: TS008-13*)
Brushless Slotted: 1.4 LPM/Watt (*PN: TS003-11*)
Brushless Slotless: 1.8 LPM/Watt (*PN: TS001-13*)

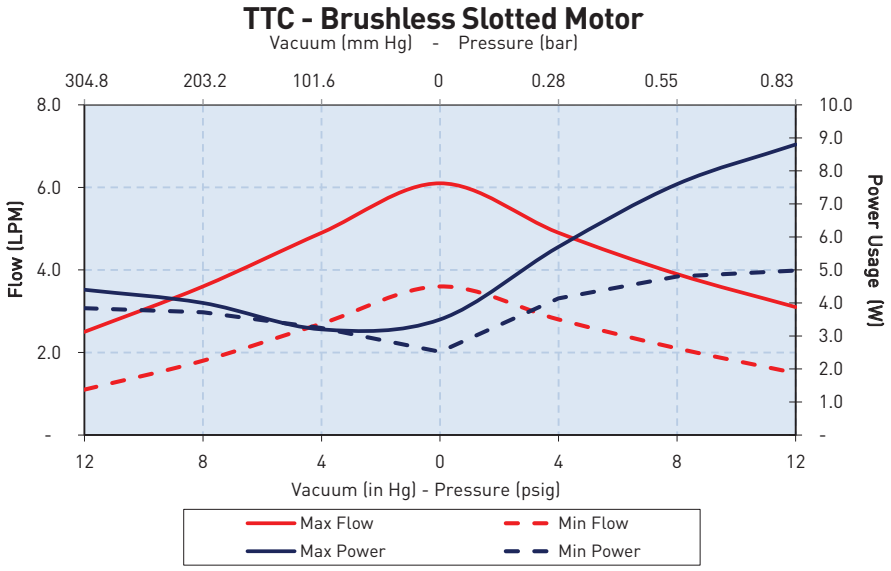
Wetted Materials

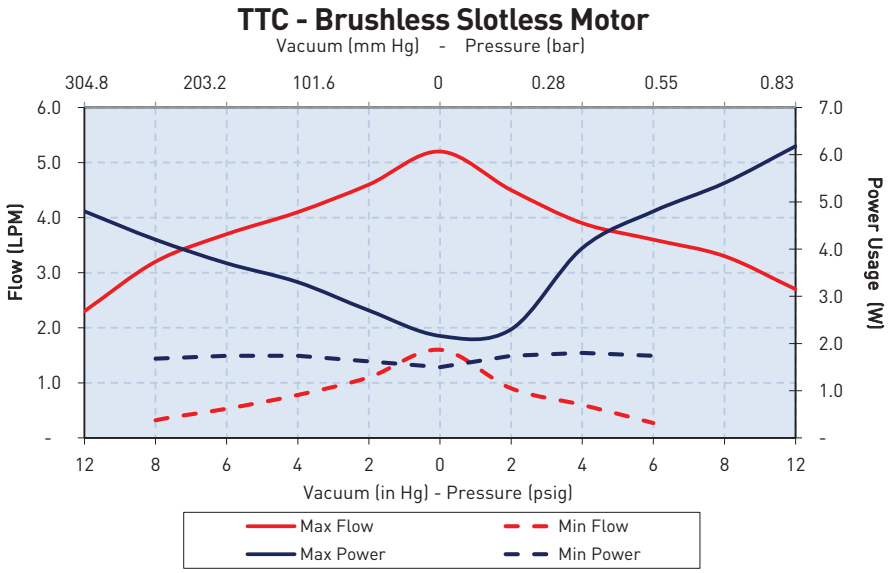
Diaphragm:	**Pump Head:**
EPDM, AEPDM, FKM	Vectra (Liquid Crystal Polymer)
Valves & Gaskets:	**Valve Cover:**
EPDM, FKM	303 Stainless Steel

* See Appendix A for details.

TTC Series Miniature Diaphragm Pumps (air/gas)

Performance Specifications





The above graph represents an example of performance for the pumps series handling air at 800 feet (244m) above sea level at 75°F (24°C). Performance will vary depending on barometric pressure and media temperature. Curves are representative of standard pump configurations. Pump configurations could be customized for higher or lower flows, depending on specific customer requirements.

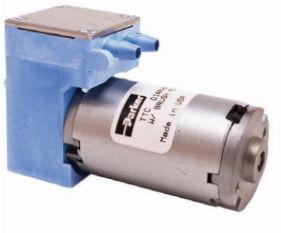
Please contact Parker Precision Fluidics Applications Engineering for other considerations.

TTC Series Miniature Diaphragm Pumps (air/gas)

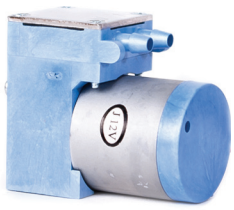
Sizing and Selection continued

TTC Series

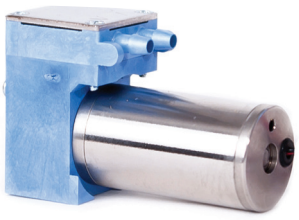
PMDC Iron Core Brush



Brushless Slotted Motor



Brushless Slotless Motor



	PMDC Iron Core Brush	Brushless Slotted Motor	Brushless Slotless Motor
Efficiency[1]	Good	**Better** - Up to 60% motor efficiency at low loads	**Best** Up to 75% motor efficiency
Life[2]	Good - 3,000 hrs	**Best** - 10,000 hrs	**Best** - 10,000 hrs
Cost	Best	Better	Premium
Noise	Good	Better	Best

Mounting Guidelines:

- Bracket options available for mounting consideration (*See EZ Mount catalog pages).*
- Hole in the center of the bottom of housing is for manufacturing only–not to be used for mounting.
- Mounting holes are drilled for #6-20 self-tapping screws with 1/4" (6 mm) thread engagement, torque to 4 in-lbs (0.45 N-m).

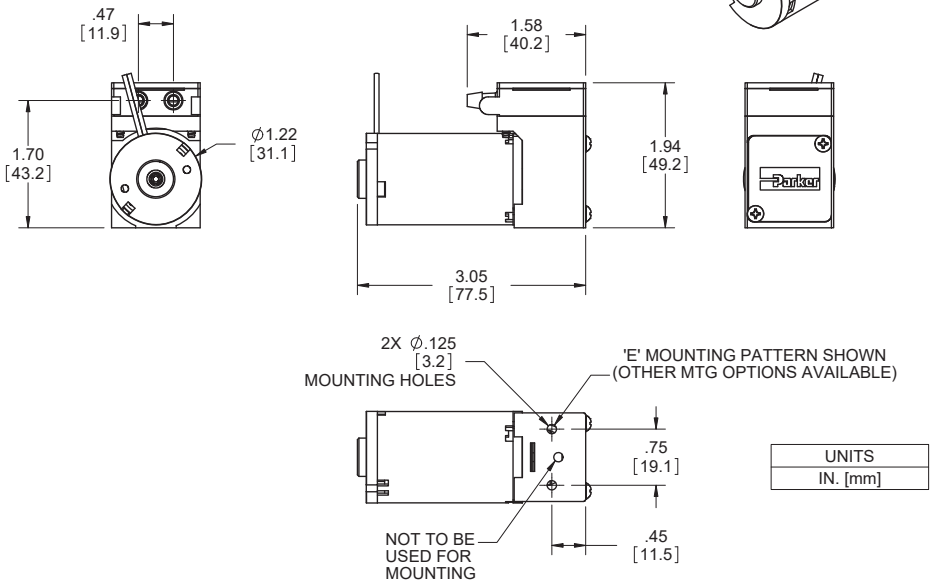
Port Connections:

- Barbs are sized for 1/8" (3 mm) ID tubing, 70-80 durometer recommended.
- Flow direction is marked on the pump head with arrows.

Mechanical Integration

Dimensions

PMDC Iron Core Brush

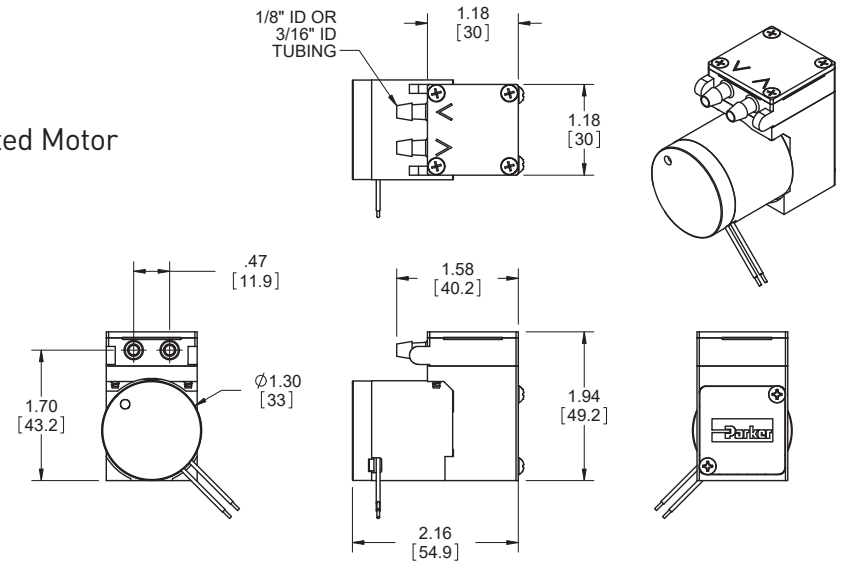


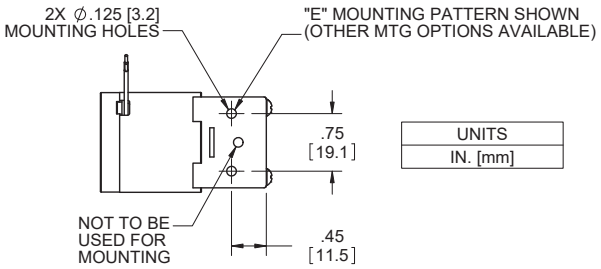
Parker

TTC Series

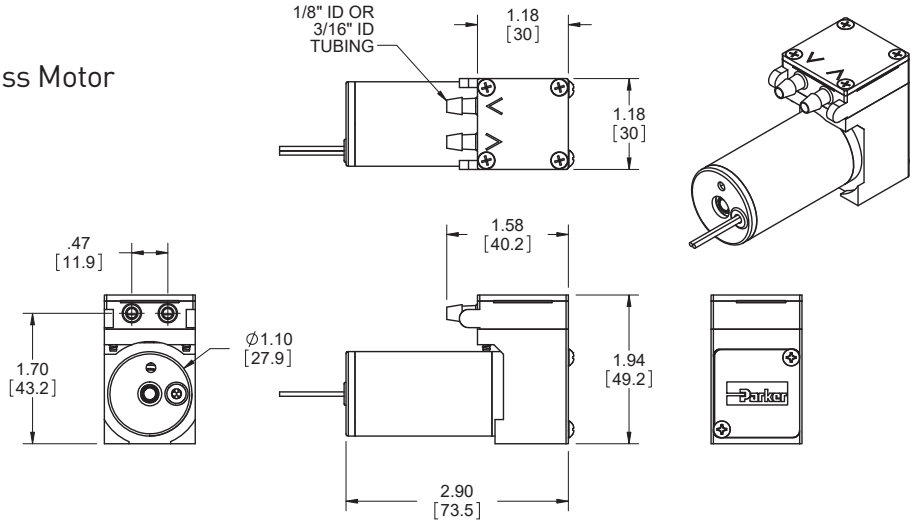
Miniature Diaphragm Pumps (air/gas)

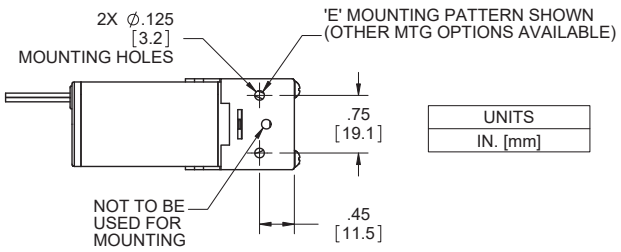
Brushless Slotted Motor





Brushless Slotless Motor





Electrical Integration and Motor Control

PMDC Iron Core Brush Motor

2 Wire	Red (+), Black (-)
Wire specification	22 AWG, Insulation OD 0.051 in (1.30 mm), 10" (254 mm) Wire Leads

Brushless Motor Control Options

2 Wire	Red (+), Black (-)
3 Wire (Speed Control)	Red (+), Black (-), White (PWM) or Yellow (Analog)
4 Wire (Speed Control & Feedback)	Red(+), Black (-), White (PWM) or Yellow (Analog), Blue (Tachometer)
Wire specification	22 AWG, Insulation OD 0.051 in (1.30 mm), 20" (508 mm) Wire Leads

Other Motor Control Considerations

The drive electronics for the BLDC motors are integrated into the motor itself, all that is needed is a power supply with the sufficient voltage and current.

Key Things to Remember

The pump is not a pressure holding device. An external check valve is recommended, if there is a pressure holding requirement.

Pump orientation does not affect performance or life.

Pulse Width Modulation (PWM)

Pulse-width modulation is a commonly used technique for controlling DC motors.

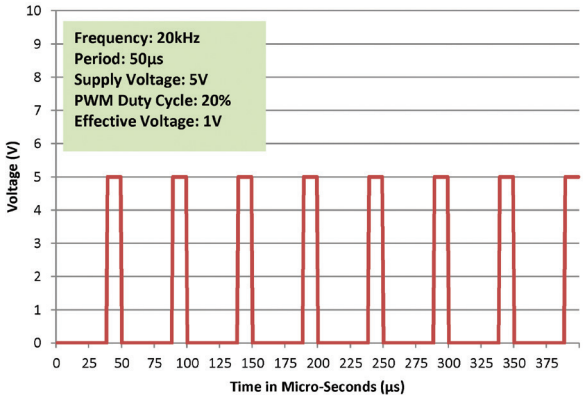
The average value of the voltage fed to the motor is controlled by turning a switch between the voltage supply and the motor on-and-off at a fast pace. The longer the switch is on compared to the off time, the higher the power supplied to the motor.

The PWM switching frequency varies for different types of devices, and is selected based on how it affects the device. For example, some applications require a faster switching frequency to prevent audible noise or electrical noise.

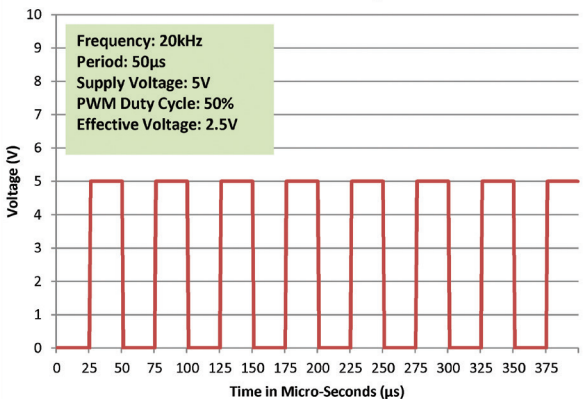
The term duty cycle describes the ratio of on-time to the period (one complete on-and-off cycle). Duty cycle is normally expressed as a percentage of on-time, 100% being full-power and 50% being half-power.

The advantage of PWM is the reduction of power-loss due to switching versus other control methods. Parker Hannifin recommends controlling the pump using 15kHz - 20 kHz frequency range.

20% PWM Example



50% PWM Example

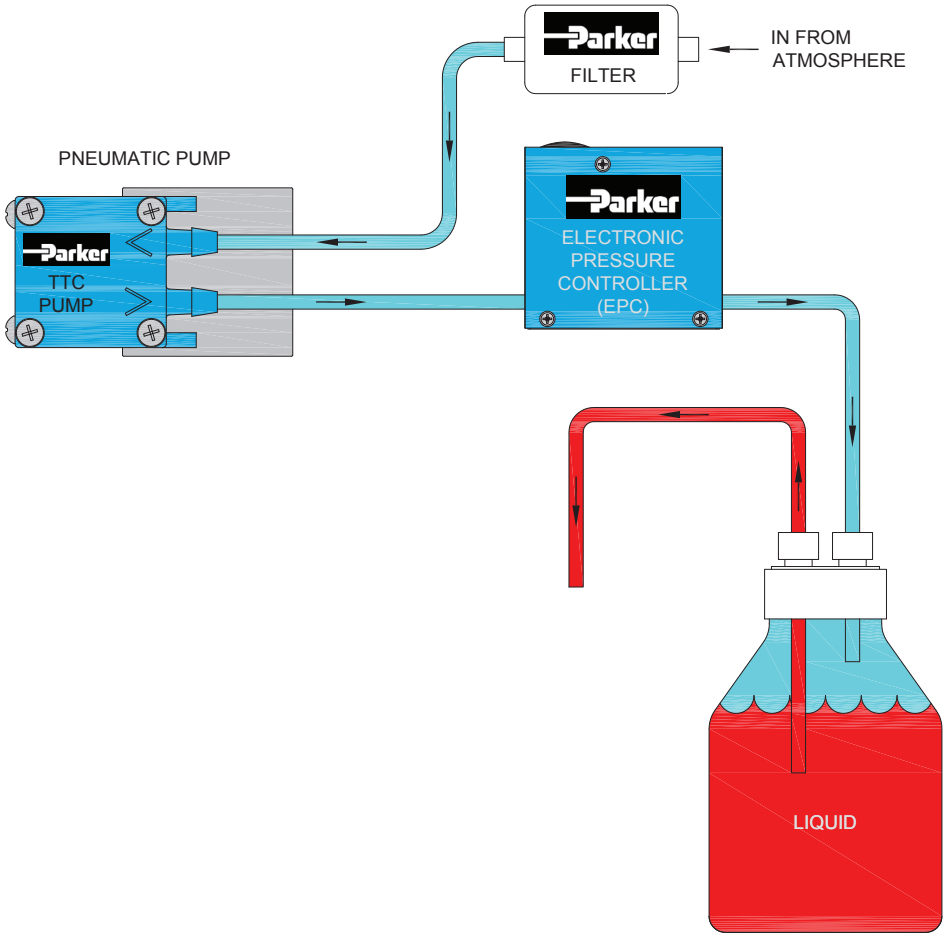


TTC Series

Miniature Diaphragm Pumps (air/gas)

Typical Flow Diagram

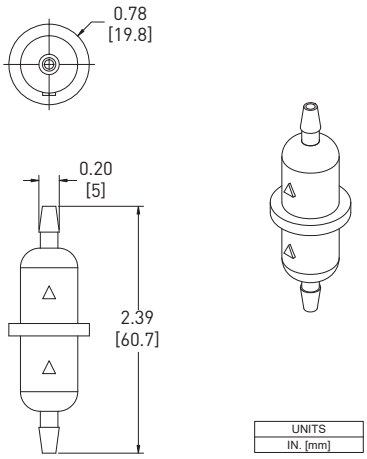
Air-Over-Liquid Flow Control



Accessory Information

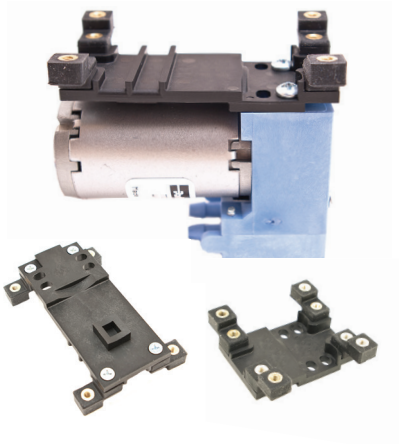
Filter-Mufflers also available to assist with filtration and optimize noise reduction.

Part Number: 00492-15
(Filters to 10 microns)



Accessory Information

EZ Mount available



EZ Mount provides ease of installation and effective control of vibration transfer. EZ Mount was designed to mount easily to the Precision Fluidic TTC Family of diaphragm pumps.

Features

- Isolation feet on the EZ mount can be rotated in any one of three ninety-degree planes and is designed for top-down or bottom-up mounting providing simple installation.
- EZ Mount was designed to minimize weight added to the pump assembly. Approximate weights are: Style A - 0.63 oz (18 g), Style B - 0.71 oz (20 g).
- Effectively absorbs vibration to minimize most vibration-induced noise and vibration transfer into an instrument.
- Designed to keep height and size to a minimum.
- Engineered for Parker TTC pumps to ease integration into your system.

Physical Properties

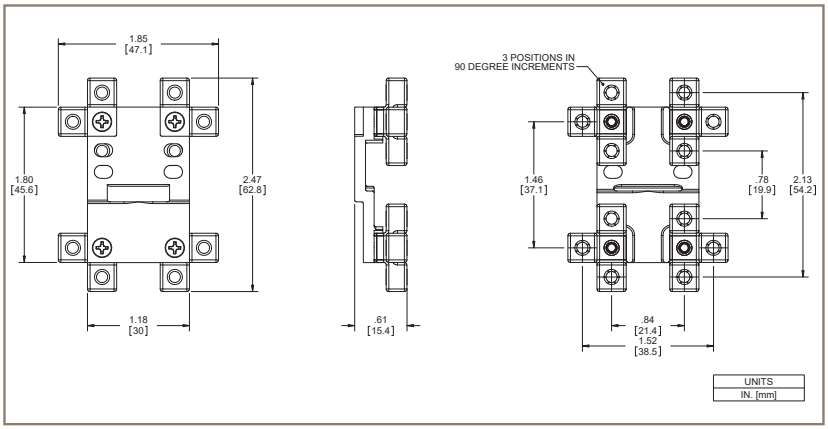
Operating Environment:
41 - 158°F (5 - 70°C)
Humidity:
0 - 95% Relative Humidity
Base Plate:
Noryl GTX830
Feet:
Silicone
Feet Insert:
Brass
Hardware:
Zinc-Plated Steel

EZ Mount kits include all necessary hardware and detailed instructions.

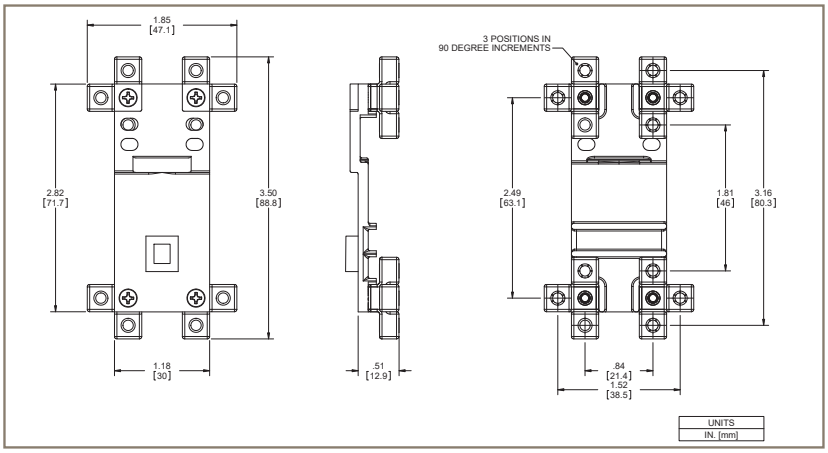
Isolation Feet are available in either threaded or thru-hole clearance for standard #4-40 or #6-32 (M3 for clearance hole only) hardware and can be mounted in any of three ninety-degree planes.

Dimensions

Style A - Brushless Slotted Motor



Style B - PMDC Iron Core Brush Motor



TTC Series Miniature Diaphragm Pumps (air/gas)

Chemical Compatibility Chart*

	Chemical Compatibility of Wetted Path Materials					
Chemical	FKM	EPDM	AEPDM	PTFE	Vectra A130	303 Stainless
Air	1	1	1	1	1	1
Ozone (1000 ppm)	4	4	4	2	2	2
Oxygen	1	1	1	1	1	1
Ethylene (Ethene)	1	4	1	1	3	2
Acetylene	1	1	1	1	1	1
Propane	1	4	4	1	1	1
Methane	1	4	4	1	1	1
Nitrogen	1	1	1	1	1	1
Carbon Dioxide	1	2	2	1	1	1
Halothane (Up to 5%)	1	4	4	1	1	1

*The above is an Abbreviated Chemical Compatibility Chart. Please consult factory for details.

Compatibility Legend

1. EXCELLENT
   Minimal or no effect
2. GOOD
   Possible swelling and/or loss of physical properties
3. DOUBTFUL
   Moderate or severe swelling and loss of physical properties
4. NOT RECOMMENDED
   Severe effect and should not be considered

Note: Consult factory for other gases.

Ordering Information

TTC Single Head Pumps - General Purpose

Part No.	Vacuum: LPM @ Load				Free Flow	Pressure: LPM @ Load				Max					PCD*	Wetted Materials
	16 in Hg 406 mm Hg	12 in Hg 305 mm Hg	8 in Hg 203 mm Hg	4 in Hg 102 mm Hg	0	4 psig 276 mbar	8 psig 552 mbar	12 psig 827 mbar	16 psig 1103 mbar	Vac in Hg	Press psig	Motor Type	VDC	mA	Diaphragm, Valves, Gasket
TS002-12		2.5	3.6	5.9	**6.1**					16.0		Brushless Slotted	12	520	EPDM
TS001-13					**6.0**	4.9	3.9	3.1			16.0	Brushless Slotted	12	735	EPDM
TS008-13					**6.0**	4.7	3.9	3.2			16.0	PMDC Brush	12	660	EPDM
TS008-12		2.5	3.6	4.8	**5.8**					16.0		PMDC Brush	12	500	EPDM
TS005-13					**5.2**	3.9	3.3	2.7			16.0	Brushless Slotless	12	515	EPDM
TS006-12		2.3	3.2	4.1	**5.1**					16.0		Brushless Slotless	12	400	EPDM
TS003-11		1.1	1.8	2.7	**3.6**	2.8	2.1	1.5		12.0	16.0	Brushless Slotted	12	415	EPDM
TS007-11			0.3	0.8	**1.6**	0.6	0.3*			16.0		Brushless Slotless	12	150	EPDM

*PCD: Peak Current Draw

Note: The Ordering Information Section includes a few selected part numbers for the product line. Other performances and configurations are available. Please contact your Sales Representative or an Application Engineer to discuss your application needs.

Ordering Information

Accessory Information

Part No.	Filtering Level (Micron)		Filter Area	Internal Volume	Operating Limitations:			Wetted Materials
00492-15	10		1.71 in^2 (11 cm^2)	0.24 in^3 (3.9 cm^3)	Max Temperature 80°C	Min Temperature 32°C	Max Pressure 65 PSI (4.48 bar)	Polypropylene
	Filter-Mufflers: To assist with filtration and optimize noise reduction. Tubing: Recommendation 1/8" (3mm) ID.							

EZ Mount for TTC Single Head Pump with PMDC Iron Core Brush Motor

Part Number	Style	Description
00329-10-A45S	B	#4-40 Threaded
00329-10-B45S	B	#4 Clearance
00329-10-D45S	B	#6-32 Threaded
00329-10-C45S	B	#6 / M3 Clearance

EZ Mount for TTC Single Head Pump with Brushless Slotted Motor

Part Number	Style	Description
00328-10-A45S	A	#4-40 Threaded
00328-10-B45S	A	#4 Clearance
00328-10-D45S	A	#6-32 Threaded
00328-10-C45S	A	#6 / M3 Clearance

EZ Mount for TTC Single Head Pump with Brushless Slotless Motor

Part Number	Style	Description
01074-10-A45S	B	#4-40 Threaded
01074-10-B45S	B	#4 Clearance
01074-10-D45S	B	#6-32 Threaded
01074-10-C45S	B	#6 / M3 Clearance

Please click on the Order On-line button below (or go to www.parker.com/precisionfluidics/ttc) to configure the TTC Miniature Diaphragm Pump in your application.

Serviceable – PPF products are designed for use through the rated life and Parker does not sell replacement parts, nor is it recommended to service these in the field

Note: In addition to Parker's innovative and flexible pump designs, we offer applications engineering expertise to our customers in order to configure and recommend the optimal pump for the application. Contact Parker Applications Engineering to discuss and configure alternate pump configurations to meet your specific application requirements. Providing information on the following requirements will assist us in developing an optimal solution for your application:

- Noise
- Operating Pressure / Vacuum
- Power Consumption
- Life Requirement
- Function in the Application
- Size
- Motor Control
- Media
- Voltage

Parker Hannifin Precision Fluidics Division reserves the right to make changes. Drawings are for reference only.

Appendix A

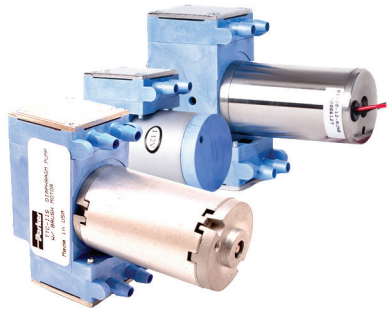
All performance data is typical based on standard conditions: 70°F and 14.7 psia (21°C and 1 bar).

1. Duty Dependent. For operation above 122°F (50°C) consult factory
2. Noise is dependent on the configuration and operation of the pump in the application. Parker has the ability to tailor the pump configuration when noise is a critical criterion in the effort to meet the performance requirements of the application. Noise level is tested to Parker protocol P-105.
3. Life rating can vary depending on application and operating conditions.
4. Custom motor options available. Custom motors may require a significant application potential. The standard motors can be configured with a special winding to meet a particular operation point at a specified voltage
5. Current range is dependent on motor type, voltage, pressure/vacuum and flow requirement. Lower levels possible depending on application.
6. Pump efficiency is a measure of the flow rate generated per unit of power consumed. Efficiency may change dependent on application and operating condition at free flow.

TTC-IIS Series

Up to 11 LPM Free Flow

Miniature Diaphragm Pumps (air/gas)



TTC-IIS Miniature Diaphragm Pumps are a series of brush and brushless DC motor driven pumps, which are tailored to meet the specific application performance requirements. An innovative compact design incorporates leading edge technologies that allow them to operate more efficiently than existing pump designs. TTC-IIS pumps offer multiple component configurations allowing them to be used for either vacuum, pressure, or alternating vacuum and pressure operations. The TTC-IIS Series is best for compact and low pressure applications that require high efficiency.

Applications

- Gas Analysis
- Anesthesia Monitors
- CO_2 Monitors
- Patient Monitoring
- Wound Therapy
- Urinalysis
- Trace Detection
- Medical/Training Mannequins
- Degassing

Features

- TTC-IIS Series' innovative and efficient design pushes the performance envelope in a lightweight, compact size which allows it to operate at the highest performance/size ratio.
- Highest efficiency in class. The TTC-IIS supports low power for portable and battery powered instruments.
- Using our proprietary advanced diaphragm elastomer and superior brushless motor design sets the highest benchmark for service-free operation that exceeds 10,000 hours.
- Incorporating the lightweight EZ Mount accessory facilitates simple system assembly while dampening vibration and reducing noise levels.
- RoHS compliant.

Product Specifications*

Physical Properties

Operating Environment[1]:
41 to 122°F (5 to 50°C)
Storage Environment:
-4 to 212°F (-20 to 100°C)
Media:
Air, Argon, Helium, Nitrogen, Oxygen, and other non-reacting gases
Humidity:
0 – 80% Relative Humidity
Noise Level[2]:
As low as 45dB @ 12 in (30 cm) *Muffler recommended for additional noise reduction (see accessories)*
Pump Assembly Rated Life[3]:
PMDC Iron Core Brush - 3,000 hrs Brushless Slotted - 10,000 hrs Brushless Slotless - 10,000 hrs
Weight:
8.6 oz. (244 g) PMDC Iron Core Brush 6.2 oz. (176 g) Brushless Slotted 9.0 oz. (255 g) Brushless Slotless

Electrical

Motor Type (DC):
PMDC Iron Core Brush, Brushless Slotted, Brushless Slotless
Nominal Motor Voltages[4]:
6, 12 or 24 VDC *Other voltages available upon request*
Electrical Termination:
PMDC Iron Core Brush: 22 AWG Wire Leads, Length 10" (254 mm) Brushless Slotted Motor: 22 AWG Wire Leads, Length 20" (508 mm) Brushless Slotless: 22 AWG Wire Leads, Length 20" (508 mm)
Current Range[5]:
240 - 880 mA

Wetted Materials

Diaphragm:
EPDM, AEPDM, FKM
Valves & Gaskets:
EPDM, FKM
Pump Head:
Vectra (Liquid Crystal Polymer)
Valve Cover:
303 Stainless Steel

Pneumatic

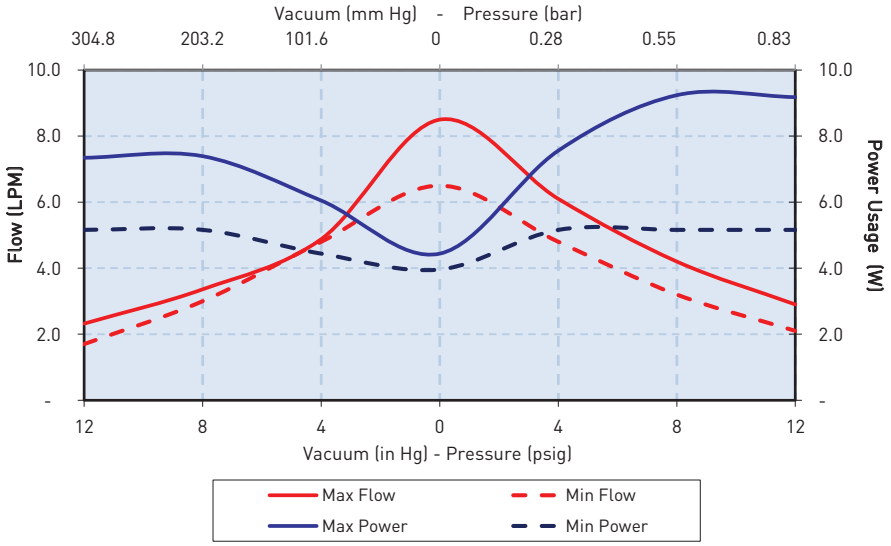
Head Configuration:
Dual
Maximum Unrestricted Flow:
6 LPM (Per head), 11 LPM (Parallel)
Pressure Range:
0 - 12 psig (0 - 0.8 bar) Parallel
Vacuum Range:
0 - 16 in Hg (0 - 406 mm Hg)
Filtration
40 microns - recommended
Efficiency at Free Flow[6]
PMDC Iron Core Brush: 1.2 LPM/Watt (*PN: TD001-13*) Brushless Slotted: 1.6 LPM/Watt (*PN: TD003-11*) Brushless Slotless: 1.5 LPM/Watt (*PN: TD005-12*)

* See Appendix A for details.

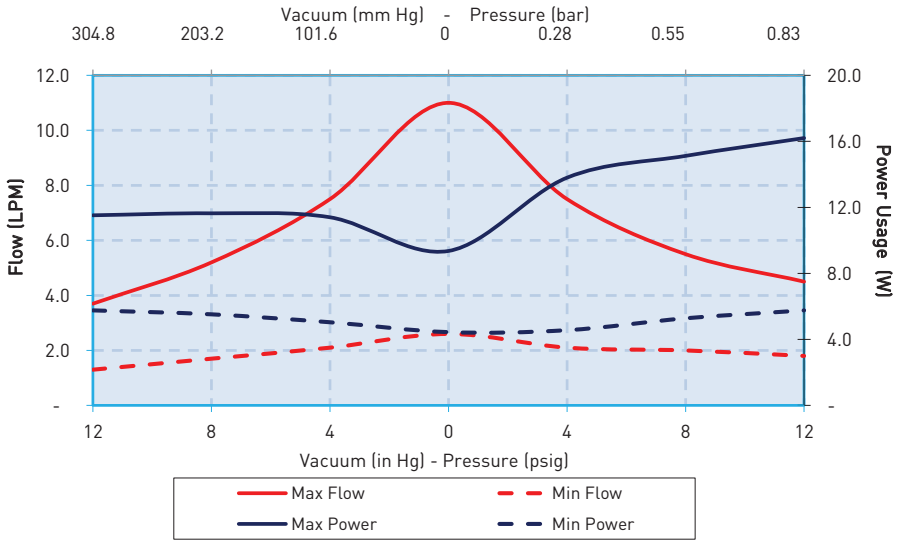
TTC-IIS Series Miniature Diaphragm Pumps (air/gas)

Performance Specifications

TTC-IIS - Brushless Slotted Motor



TTC-IIS - Brushless Slotless Motor



The above graph represents an example of performance for the pumps series handling air at 800 feet (244m) above sea level at 75°F (24°C). Performance will vary depending on barometric pressure and media temperature. Curves are representative of standard pump configurations. Pump configurations could be customized for higher or lower flows, depending on specific customer requirements.

Please contact Parker Precision Fluidics Applications Engineering for other considerations.

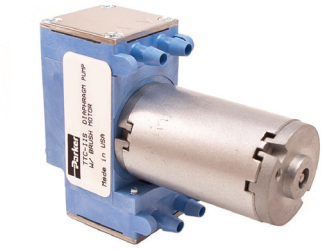
TTC-IIS Series

Miniature Diaphragm Pumps (air/gas)

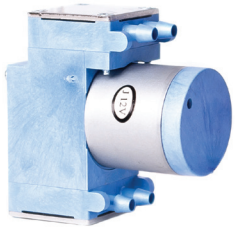
Sizing and Selection

TTC-IIS Series

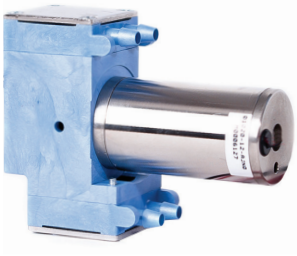
PMDC Iron Core Brush



Brushless Slotted Motor



Brushless Slotless Motor



	PMDC Iron Core Brush	Brushless Slotted Motor	Brushless Slotless Motor
Efficiency[1]	Good	**Better** - Up to 60% motor efficiency at low loads	**Best** - Up to 75% motor efficiency at high power levels
Life[2]	Good - 3,000 hrs	**Best** - 10,000 hrs	**Best** - 10,000 hrs
Cost	Best	Better	Premium
Noise	Good	Better	Best

Mounting Guidelines:

- Bracket options available for mounting consideration (*See EZ Mount catalog pages*).
- Hole in the center of the bottom of housing is for manufacturing only–not to be used for mounting.
- Mounting holes are drilled for #6-20 self-tapping screws with 1/4" (6 mm) thread engagement 4 in-lbs. (0.45 N-m).

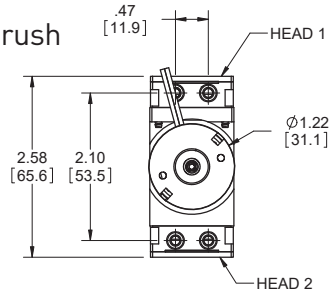
Port Connections:

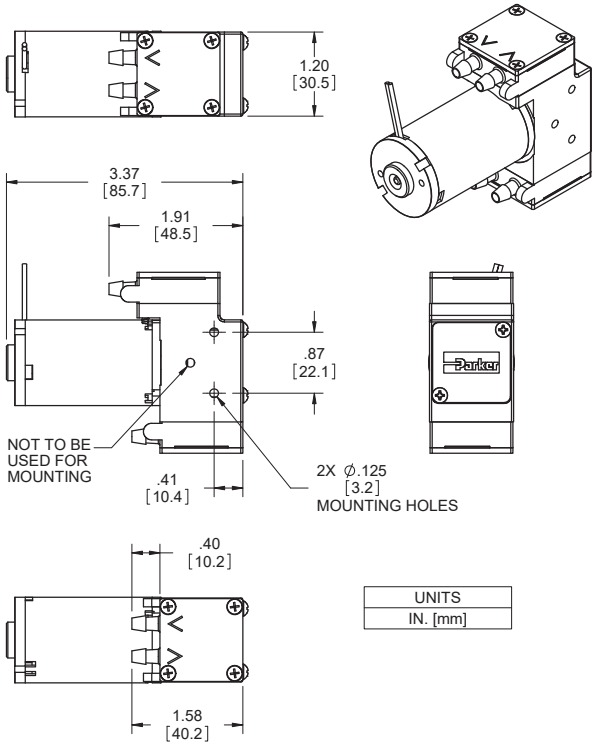
- Barbs are sized for 1/8" (3 mm) ID tubing, 70-80 durometer recommended.
- Flow direction is marked on the pump head with arrows.

Mechanical Integration

Dimensions

PMDC Iron Core Brush

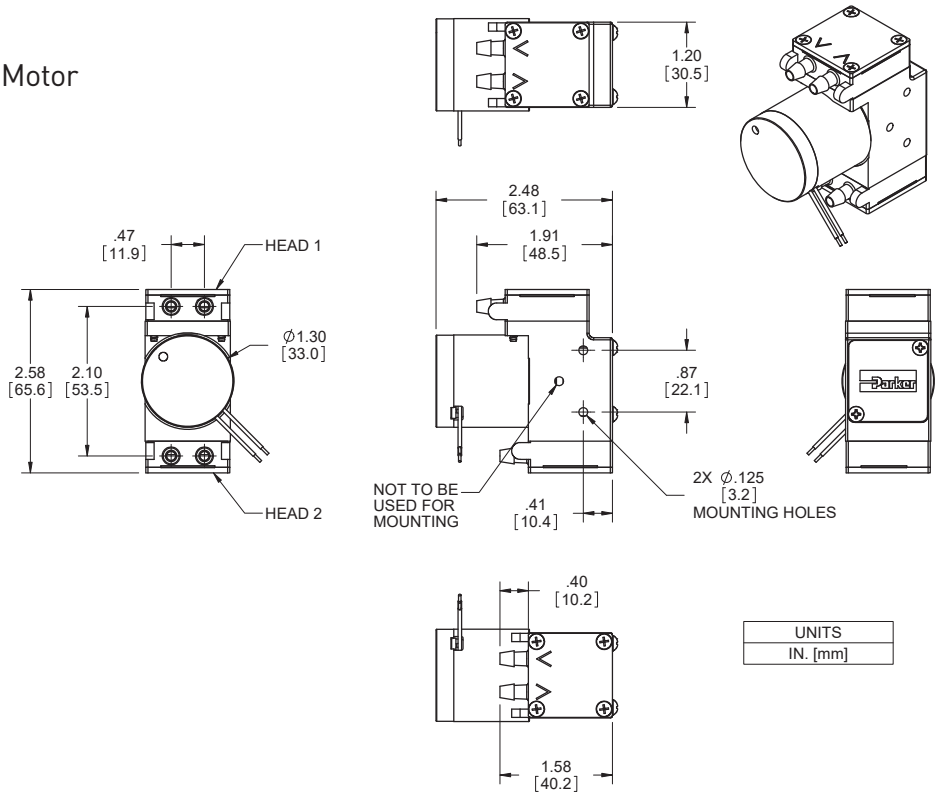




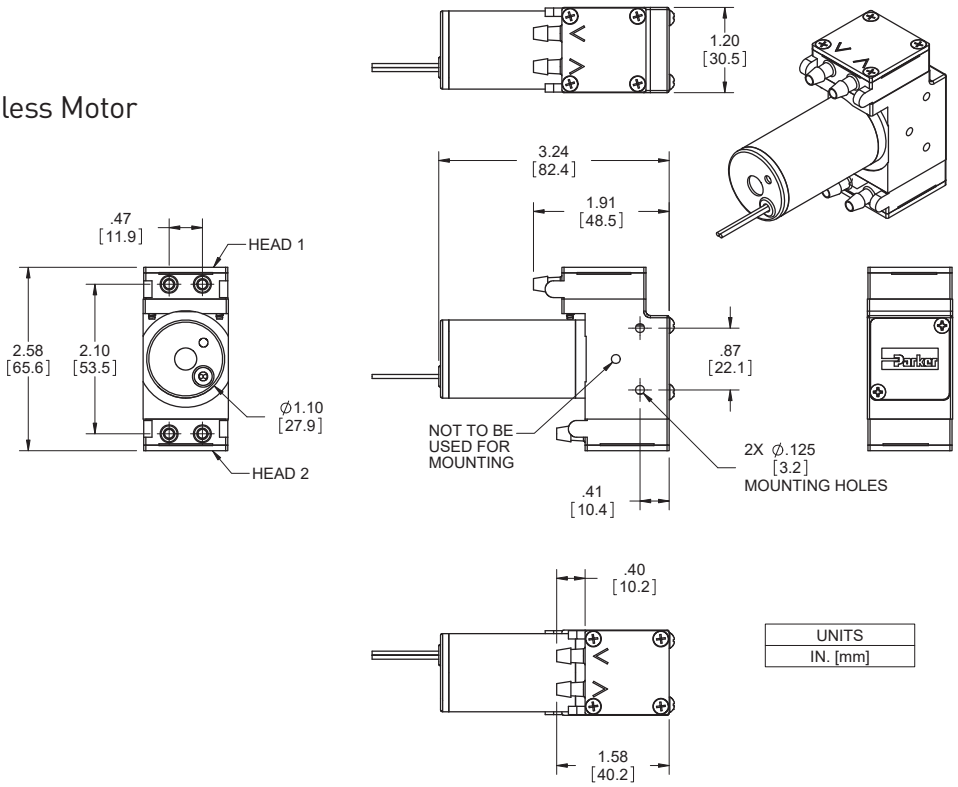
TTC-IIS Series Miniature Diaphragm Pumps (air/gas)

Mechanical Integration

Brushless Slotted Motor



Brushless Slotless Motor



Electrical Integration and Motor Control

PMDC Iron Core Brush Motor

2 Wire	Red (+), Black (-)
Wire specification	22 AWG, Insulation OD 0.051 in (1.30 mm), 10" (254 mm) Wire Leads

Brushless Motor Control Options

2 Wire	Red (+), Black (-)
3 Wire (Speed Control)	Red (+), Black (-), White (PWM) or Yellow (Analog)
4 Wire (Speed Control & Feedback)	Red(+), Black (-), White (PWM) or Yellow (Analog), Blue (Tachometer)
Wire specification	22 AWG, Insulation OD 0.051 in (1.30 mm), 20" (508 mm) Wire Leads

Other Motor Control Considerations

The drive electronics for the BLDC motors are integrated into the motor itself, all that is needed is a power supply with the sufficient voltage and current.

Key Things to Remember

The pump is not a pressure holding device. An external check valve is recommended, if there is a pressure holding requirement.

Pump orientation does not affect performance or life.

Pulse Width Modulation (PWM)

Pulse-width modulation is a commonly used technique for controlling DC motors.

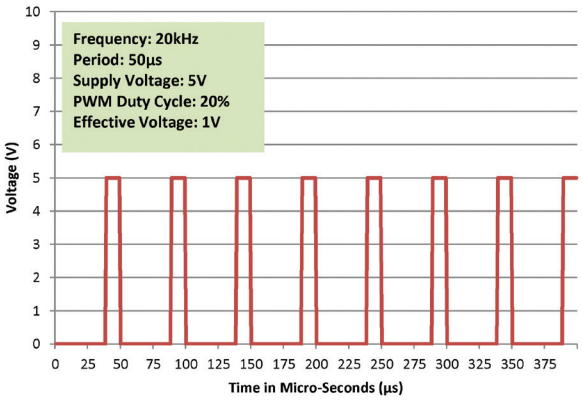
The average value of the voltage fed to the motor is controlled by turning a switch between the voltage supply and the motor on-and-off at a fast pace. The longer the switch is on compared to the off time, the higher the power supplied to the motor.

The PWM switching frequency varies for different types of devices, and is selected based on how it affects the device. For example, some applications require a faster switching frequency to prevent audible noise or electrical noise.

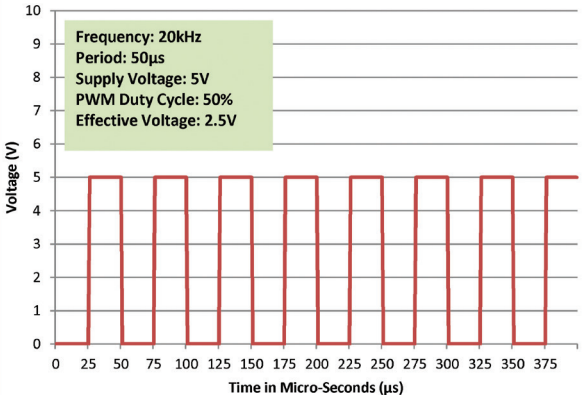
The term duty cycle describes the ratio of on-time to the period (one complete on-and-off cycle). Duty cycle is normally expressed as a percentage of on-time, 100% being full-power and 50% being half-power.

The advantage of PWM is the reduction of power-loss due to switching versus other control methods. Parker Hannifin recommends controlling the pump using 15kHz - 20 kHz frequency range.

20% PWM Example



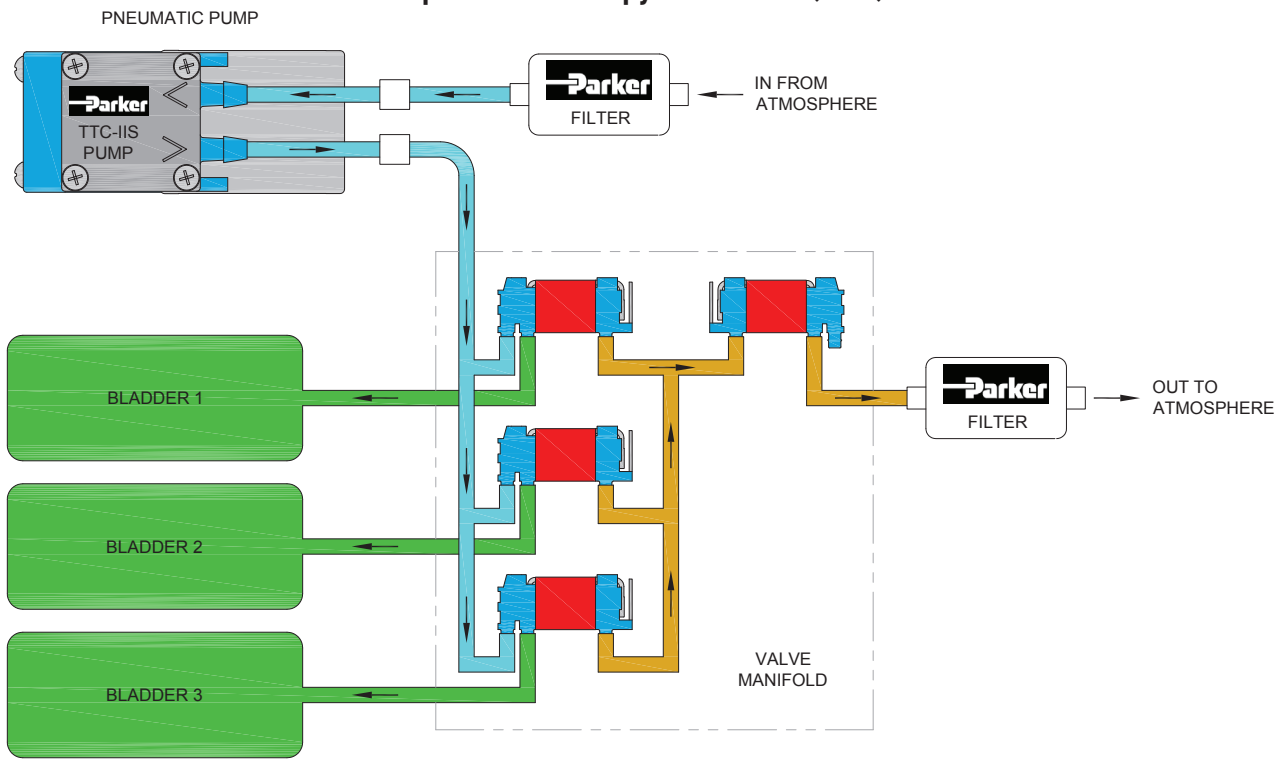
50% PWM Example



TTC-IIS Series Miniature Diaphragm Pumps (air/gas)

Typical Flow Diagram

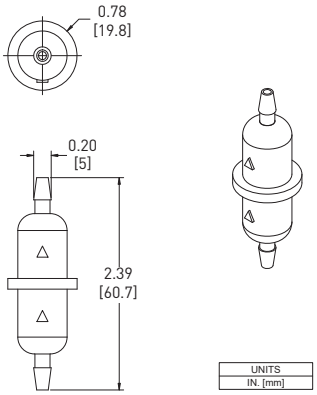
Compression Therapy Prevention (DVT)



Accessory Information

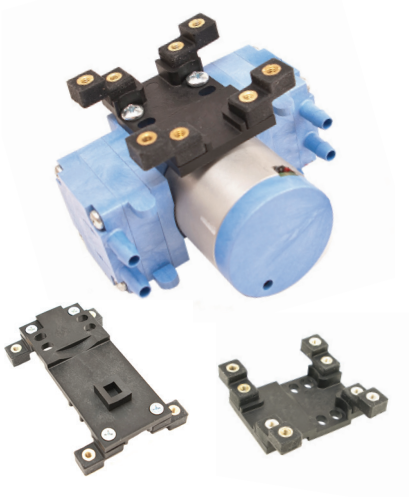
Filter-Mufflers also available to assist with filtration and optimize noise reduction.

Part Number: 00492-15
(Filters to 10 microns)



Accessory Information

EZ Mount available



EZ Mount provides ease of installation and effective control of vibration transfer. EZ Mount was designed to mount easily to the Precision Fluidic TTC-IIS Family of diaphragm pumps.

Features

- Isolation feet on the EZ mount can be rotated in any one of three ninety-degree planes and is designed for top-down or bottom-up mounting providing simple installation.
- EZ Mount was designed to minimize weight added to the pump assembly. Approximate weights are: Style A - 0.63 oz (18 g), Style B - 0.71 oz (20 g).
- Effectively absorbs vibration to minimize most vibration-induced noise and vibration transfer into an instrument.
- Designed to keep height and size to a minimum.
- Engineered for Parker TTC-IIS pumps to ease integration into your system.

Physical Properties

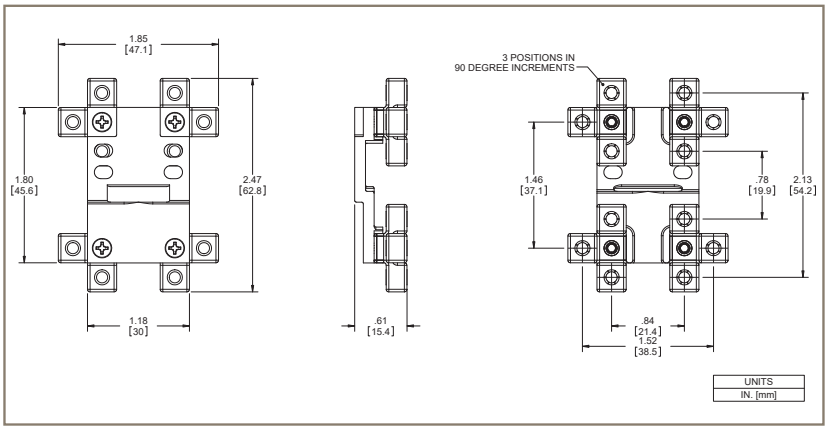
Operating Environment:
41 - 158°F (5 - 70°C)
Humidity:
0 - 95% Relative Humidity
Base Plate:
Noryl GTX830
Feet:
Silicone
Feet Insert:
Brass
Hardware:
Zinc-Plated Steel

EZ Mount kits include all necessary hardware and detailed instructions.

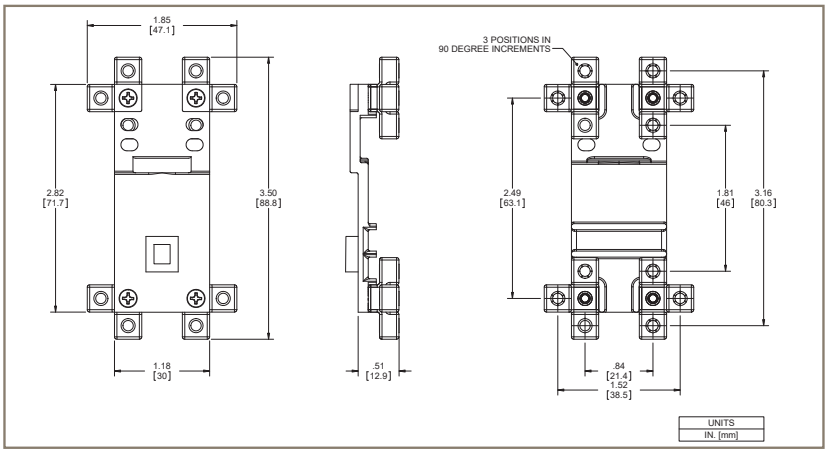
Isolation Feet are available in either threaded or thru-hole clearance for standard #4-40 or #6-32 (M3 for clearance hole only) hardware and can be mounted in any of three ninety-degree planes.

Dimensions

Style A - Brushless Slotted Motor



Style B - PMDC Iron Core Brush Motor



TTC-IIS Series Miniature Diaphragm Pumps (air/gas)

Chemical Compatibility Chart*

	Chemical Compatibility of Wetted Path Materials					
Chemical	FKM	EPDM	AEPDM	PTFE	Vectra A130	303 Stainless
Air	1	1	1	1	1	1
Ozone (1000 ppm)	4	4	4	2	2	2
Oxygen	1	1	1	1	1	1
Ethylene (Ethene)	1	4	1	1	3	2
Acetylene	1	1	1	1	1	1
Propane	1	4	4	1	1	1
Methane	1	4	4	1	1	1
Nitrogen	1	1	1	1	1	1
Carbon Dioxide	1	2	2	1	1	1
Halothane (Up to 5%)	1	4	4	1	1	1

*The above is an Abbreviated Chemical Compatibility Chart. Please consult factory for details.

Compatibility Legend

1. EXCELLENT
   Minimal or no effect
2. GOOD
   Possible swelling and/or loss of physical properties
3. DOUBTFUL
   Moderate or severe swelling and loss of physical properties
4. NOT RECOMMENDED
   Severe effect and should not be considered

Note: Consult factory for other gases.

Ordering Information

TTC-IIS Dual Head Pumps - General Purpose

Part No.	Vacuum: LPM @ Load				Free Flow	Pressure: LPM @ Load				Max				PCD*	Wetted Materials
	16 in Hg 406 mm Hg	12 in Hg 305 mm Hg	8 in Hg 203 mm Hg	4 in Hg 102 mm Hg	0	4 psig 276 mbar	8 psig 55 mbar	12 psig 827 mbar	16 psig 1103 mbar	Vac in Hg	Press psig	Motor Type	VDC	mA	Diaphragm, Valves, Gasket
TD003-11		1.7	3.0	4.8	**6.5**	4.8	3.2	2.1		12.0	16.0	Brushless Slotted	12	570	AEPDM, EPDM, EPDM

TTC-IIS Dual Head Pumps - High Flow

Part No.	Vacuum: LPM @ Load				Free Flow	Pressure: LPM @ Load				Max				PCD*	Wetted Materials
	16 in Hg 406 mm Hg	12 in Hg 305 mm Hg	8 in Hg 203 mm Hg	4 in Hg 102 mm Hg	0	4 psig 276 mbar	8 psig 55 mbar	12 psig 827 mbar	16 psig 1103 mbar	Vac in Hg	Press psig	Motor Type	VDC	mA	Diaphragm, Valves, Gasket
TD001-13					**6.8**	4.9	3.4	2.4	1.5		16.0	Brushless Slotted	12	630	EPDM
TD004-13					**8.5**	6.1	4.2	2.9			16.0	Brushless Slotted	12	880	EPDM
TD005-12		3.8	5.5	7.4	**8.8**					12.0		Brushless Slotless	12	630	EPDM
TD002-13					**8.5**	6.1	4.2	2.9			16.0	Brushless Slotted	12	770	EPDM

Note: The Ordering Information Section includes a few selected part numbers for the product line. Other performances and configurations are available. Please contact your Sales Representative or an Application Engineer to discuss your application needs.

Parker

Ordering Information

Accessory Information

Part No.	Filtering Level (Micron)		Filter Area	Internal Volume	Operating Limitations:			Wetted Materials
00492-15	10		1.71 in^2 (11 cm^2)	0.24 in^3 (3.9 cm^3)	Max Temperature 80°C	Min Temperature 32°C	Max Pressure 65 PSI (4.48 bar)	Polypropylene
	Filter-Mufflers: To assist with filtration and optimize noise reduction. Tubing: Recommendation 1/8" (3mm) ID.							

EZ Mount for TTC-IIS Dual Head Pump with PMDC Iron Core Brush Motor

Part Number	Style	Description
00332-10-A45S	B	#4-40 Threaded
00332-10-B45S	B	#4 Clearance
00332-10-D45S	B	#6-32 Threaded
00332-10-C45S	B	#6 / M3 Clearance

EZ Mount for TTC-IIS Dual Head Pump with Brushless Slotted Motor

Part Number	Style	Description
00328-10-A45S	A	#4-40 Threaded
00328-10-B45S	A	#4 Clearance
00328-10-D45S	A	#6-32 Threaded
00328-10-C45S	A	#6 / M3 Clearance

EZ Mount for TTC-IIS Dual Head Pump with Brushless Slotless Motor

Part Number	Style	Description
01074-10-A45S	B	#4-40 Threaded
01074-10-B45S	B	#4 Clearance
01074-10-D45S	B	#6-32 Threaded
01074-10-C45S	B	#6 / M3 Clearance

to order on-line go to www.parker.com/precisionfluidics/ttciis) to configure the TTC-IIS Miniature Diaphragm Pump.

Serviceable – PPF products are designed for use through the rated life and Parker does not sell replacement parts, nor is it recommended to service these in the field

Note: In addition to Parker's innovative and flexible pump designs, we offer applications engineering expertise to our customers in order to configure and recommend the optimal pump for the application. Contact Parker Applications Engineering to discuss and configure alternate pump configurations to meet your specific application requirements. Providing information on the following requirements will assist us in developing an optimal solution for your application:

- Noise
- Operating Pressure / Vacuum
- Power Consumption
- Life Requirement
- Description of pump function in the application
- Size
- Motor Control
- Media
- Voltage

Appendix A

All performance data is typical based on standard conditions: 70°F and 14.7 psia (21°C and 1 bar).

1. Duty Dependent. For operation above 122°F (50°C) consult factory
2. Noise is dependent on the configuration and operation of the pump in the application. Parker has the ability to tailor the pump configuration when noise is a critical criterion in the effort to meet the performance requirements of the application. Noise level is tested to Parker protocol P-105.
3. Life rating can vary depending on application and operating conditions.
4. Custom motor options available. Custom motors may require a significant application potential. The standard motors can be configured with a special winding to meet a particular operation point at a specified voltage
5. Current range is dependent on motor type, voltage, pressure/vacuum and flow requirement. Lower levels possible depending on application.
6. Pump efficiency is a measure of the flow rate generated per unit of power consumed. Efficiency may change dependent on application and operating condition at free flow.

T2-04

Micro Diaphragm Pumps (air/gas)

Up to 6.7 LPM Free Flow

The T2-04 is a high flow and ultra compact pump that is ideal for portable air and gas detection applications. Delivering flow up to 6.7 lpm, the pump works well in environments where high efficiency for extended battery life, high performance, low cost, minimal weight, and compact size are critical.

Features

- The pump with patented valve design is optimized to provide best-in-class efficiency/size ratio especially for low vacuum applications. Low power consumption enables longer battery life for small instruments.
- The pump fits into the tight spaces demanded of today's battery-powered instruments. The lightweight design keeps the instrument weight minimized.
- The high efficiency coreless brush motor can satisfy intrinsic safety requirements. It has been proven in applications for sampling of medical gases, hazardous gases, particles, and aerosols in a range of fixed and portable instruments.
- Compact dual head design with internal flow paths that require only one set of barbs for intake and discharge simplifies plumbing requirements
- RoHS Compliant

Applications

- Particle Detection
- Pathogen Detection
- Compression Therapy
- Wound Therapy
- Fuel Cell

Product Specifications*

Physical Properties

Operating Environment[1]:
32 to 122°F (0 to 50°C)
Storage Temperature:
14 to 122°F (-10 to 50°C)
Media:
Air, Argon, Helium, Nitrogen, Oxygen, and other non-reacting gases
Humidity:
5-95% Relative Humidity
Noise Level[2]:
As low as 45dB
Pump Assembly Rated Life[3]:
Up to 5,000 hrs
Weight:
3.3 oz (94 g)

Electrical

Motor Type:
High Efficiency Coreless Brush
Nominal Motor Voltages[4]:
6 VDC
Max Power in Continuous Range:
2.6 Watts
Electrical Termination:
28 AWG Wire Leads lead length 5" (127 mm)
Current Range[5]:
50 - 425 mA
Inductance[6]:
Coreless Brush: 0.266 mH max @ 1kHz/50mV

Pneumatic

Head Configuration:
Dual (Single Ported)
Maximum Flow:
6.7 lpm
Maximum Intermittent Pressure[7]:
16 psi (1103 mbar)
Maximum Continuous Pressure:
2 psi (138 mbar)
Maximum Intermittent Vacuum[7]:
-18.7 in Hg (-475 mm Hg)
Maximum Continuous Vacuum:
-4 in Hg (-101 mm Hg)
Filtration:
40 micron recommended
Efficiency at Free Flow[8]:
Coreless Brush Motor: 10 LPM/Watt @ 3 VDC (*P/N: T4-2HE-06-1SCA*)

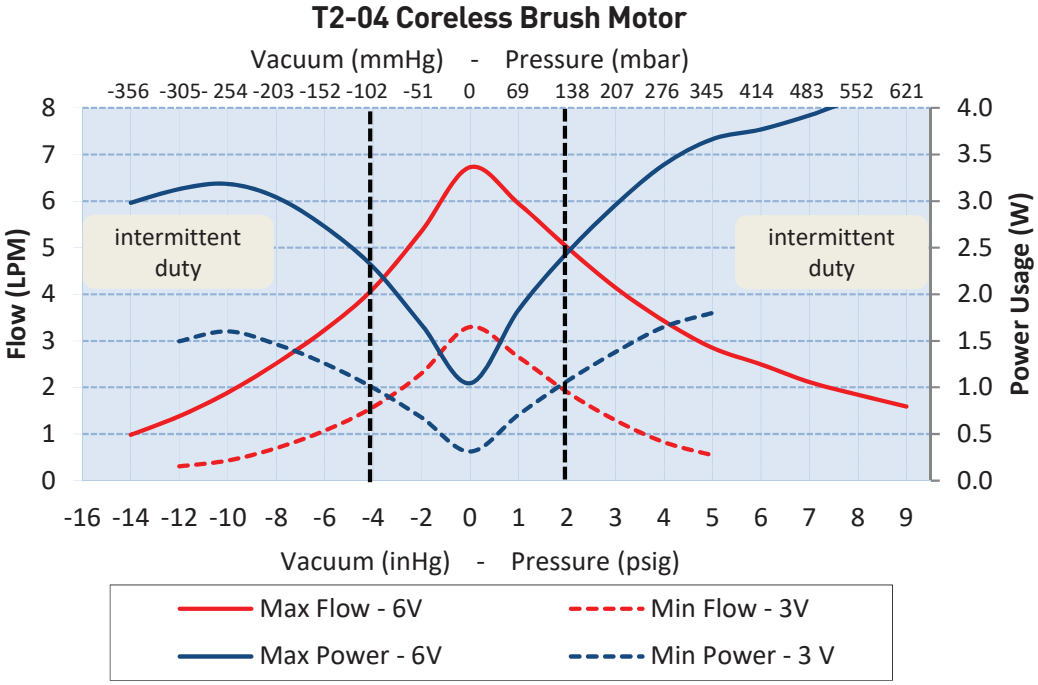
Wetted Materials

Diaphragm:	**Pump Head:**
Neoprene Rubber	Polyphthalamide (PPA)
Valves:	
Silicone	

* See Appendix A for details.

T2-04 Micro Diaphragm Pumps (air/gas)

Typical Flow Curve



The above graphs represent examples of performance for the pumps series handling air at 800 feet (244M) above sea level at 75° F (24° C). Performance will vary depending on barometric pressure and media temperature.

Curves are representative of standard pump configurations. Pump configurations could be customized for higher or lower flows, depending on specific customer requirements.

Please contact Parker Precision Fluidics Applications Engineering for other considerations

Sizing and Selection

T2-04 Series Coreless Brush Motor

Mounting Guidelines:

- Parker recommends using a nylon cable tie with a length of at least 4" (100 mm).

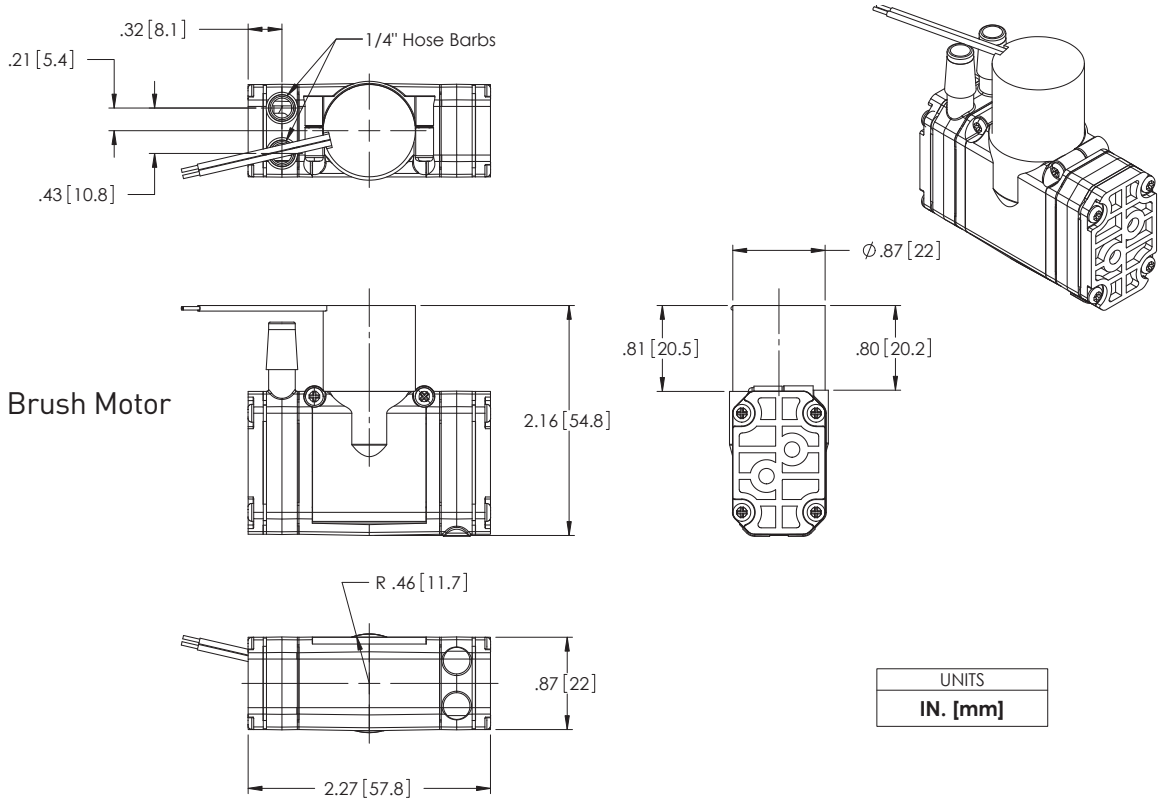
Port Connections:

- Barbs are sized for 1/4" ID tubing, 70-80 durometer recommended

Mechanical Integration

Dimensions

Coreless Brush Motor



Electrical Integration and Motor Control

If application requires variable flow, motor control options are available, as follows:

Brush Motor

2 Wire	Red (+), Black (-)
Wire specification	28 AWG 5" (127 mm) Wire Leads

Key Things to Remember

5" (127mm) flying Leads are the standard electrical connection method to the pump. Contact Applications for other connection requirements.

The pump lead wires are non-polarized.

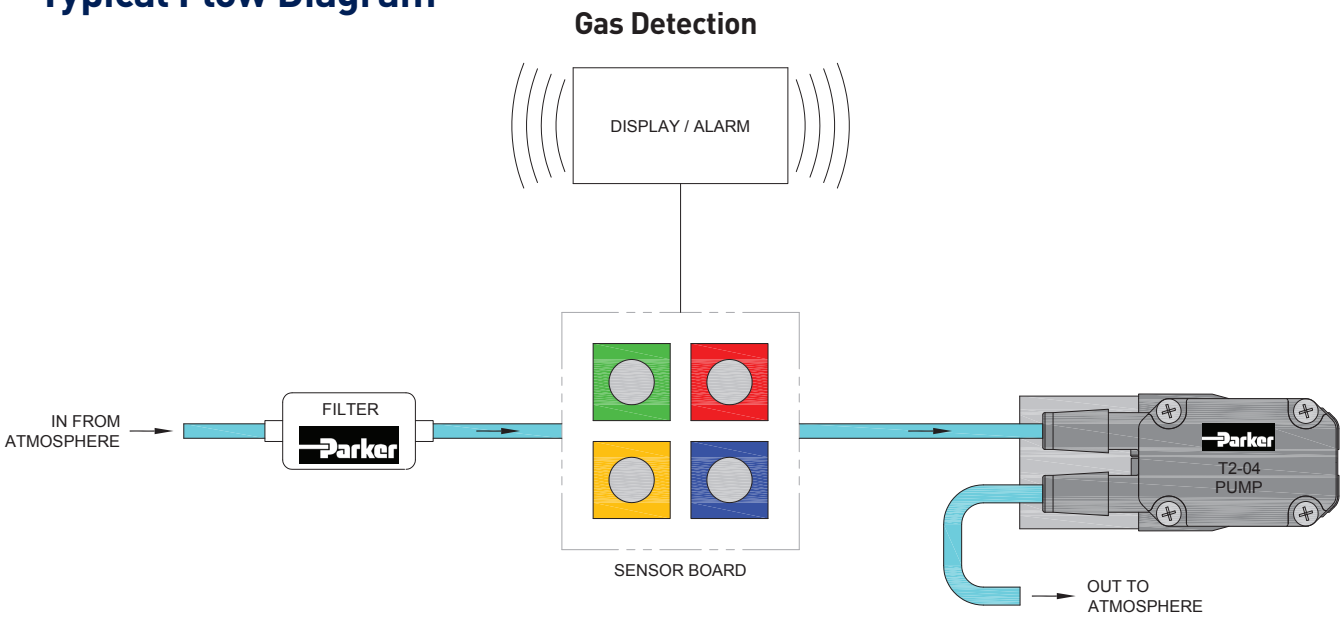
The pump can be controlled by DC voltage or PWM through a control board supplied by the customer. The minimum recommended PWM frequency is 20kHz.

The pump flow and pressure can be controlled by adjusting the input voltage.

The pump is not a pressure holding device. An external check valve is recommended, if there is a pressure holding requirement.

Pump orientation does not affect performance or life.

Typical Flow Diagram



Chemical Compatibility Chart*

	Chemical Compatibility of Wetted Path Materials		
Chemical	Neoprene Rubber(CR)	PPA	Silicone
Air	1	1	1
Ozone (1000 ppm)	3	1	1
Oxygen	1	1	2
Ethylene (Ethene)	1	1	4
Acetylene	2	1	3
Propane	1	1	4
Methane	2	1	4
Nitrogen	1	1	1
Carbon Dioxide	1	1	2
Halothane (Up to 5%)	4	1	4

*The above is an Abbreviated Chemical Compatibility Chart. Please consult factory for details.

Compatibility Legend

1. EXCELLENT
   Minimal or no effect
2. GOOD
   Possible swelling and/or loss of physical properties
3. DOUBTFUL
   Moderate or severe swelling and loss of physical properties
4. NOT RECOMMENDED
   Severe effect and should not be considered

Note: Consult factory for other gases.

Ordering Information

Configuration	Vacuum: LPM @ Load		Free Flow	Pressure: LPM @ Load		Max Continuous Pressure				Peak Current[1]	Wetted Materials[2]
Part No.	-4 inHg / -101 mmHg	-2 inHg / -50 mmHg	0	4 psig / 276 mbar	8 psig / 552 mbar	Vac inHg	Press psig	Motor Type	VDC	mA	Diaphragm, Valves, Gasket
T4-2HE-06-1SCA	4.1	5.3	**6.7**	6.0	5.0	-4	2	Coreless Brush	6	425	CR, VMQ, EPDM

1. Peak current draw in continous operating range 2. CR: Neoprene, VMQ: Silicone, EPDM: Ethylene Propylene Diene Monomer

Note: Other part number could be available for specific application configurations

To order on-line go to www.parker.com/precisionfluidics/t4) to configure the T2-04 micro pump.

Serviceable – PPF products are designed for use through the rated life and Parker does not sell replacement parts, nor is it recommended to service these in the field

Note: In addition to Parker's innovative and flexible pump designs, we offer applications engineering expertise to our customers in order to configure and recommend the optimal pump for the application. Contact Parker Applications Engineering to discuss and configure alternate pump configurations to meet your specific application requirements. Providing information on the following requirements will assist us in developing an optimal solution for your application:

- Noise
- Operating Pressure / Vacuum
- Power Consumption
- Life Requirement
- Function in the Application
- Size
- Motor Control
- Media
- Voltage

Parker Hannifin Precision Fluidics Division reserves the right to make changes. Drawings are for reference only.

Appendix A

All performance data is typical based on standard conditions: 70°F and 14.7 psia (21°C and 1 bar).

1. Duty Dependent. For operation above 122°F (50°C) consult factory
2. Noise is dependent on the configuration and operation of the pump in the application. Parker has the ability to tailor the pump configuration when noise is a critical criterion in the effort to meet the performance requirements of the application. Noise level is tested to Parker protocol P-105.
3. Life rating can vary depending on application and operating conditions.
4. Custom motor options available. Custom motors may require a significant application potential. The standard motors can be configured with a special winding to meet a particular operation point at a specified voltage
5. Current range is dependent on motor type, voltage, pressure/vacuum and flow requirement. Lower levels possible depending on application.
6. Inductance can be used to measure the viability of a component in a device requiring intrinsic safety.
7. Maximum intermittent pressure/vacuum data is a pump capability guideline for applications that go beyond the maximum continuous levels for short periods of time. Please consult customer specific requirements with the factory or Applications Engineering.
8. Pump efficiency is a measure of the flow rate generated per unit of power consumed. Efficiency may change dependent on application and operating condition at free flow.

Helix Miniature High Pressure Pump

Up to 100 PSI (6.9 bar)

The Helix is a compact, high pressure pump designed to enable the smallest of point-of-care instruments. Helix enables high pressure operation in challenging high altitude environments and applications where external compressed air is not available. Delivering more than 5.5 LPM flow and pressure up to 100 PSI (6.9 bar), the Helix pump provides the best solution for bench-top diagnostic devices where performance is critical and space is limited.

Markets

- Point-of-Care Testing
- Molecular Diagnostics
- Nucleic Acid Purification
- Genomics

Applications

- Air Over Liquid
- Pneumatic Actuation
- Microfluidic Chips

Features

- Integrated unloading X-Valve enables high pressure restarts
- Internal flywheel for low speed operation at high pressure
- Oil free piston
- Simple mounting features
- Fast fluid connections with push-in fittings
- RoHS and REACH compliant

Product Specifications

Physical Properties

Operating Environment[1]:
41 to 113°F (5 to 45°C)

Storage Environment:
-22 to 158°F (-30 to 70°C)

Humidity:
Up to 80% Relative Humidity
Non-condensing

Wetted Materials:
PPS, FKM, EPDM, PTFE
Aluminum, 316 Stainless Steel
The Helix pump is not sealed and not designed to pump gases that cannot escape to the environment

Weight:
Helix pump with Unloading Valve:
20.3 oz (576 g)

Pneumatic

Maximum Unrestricted Flow:
Up to 5.5 LPM @ 3000 RPM

Pressure Range:
Pressure Only Operation
Continuous Duty: 60 PSIG (4.1 Barg)
Operating @1400 RPM
(1.5 Vdc Control)
Intermittent Duty: Up to 100 PSIG (6.9 Barg)

Pneumatic Connections:
6mm Male Ports for Push-in Fittings

Unloading Valve:
Valve Type: 2-Way NO X-Valve
Continuous Duty: 100 PSIg (6.9 Barg)
Voltage: 24 VDC
Power: 1 Watt

Electrical

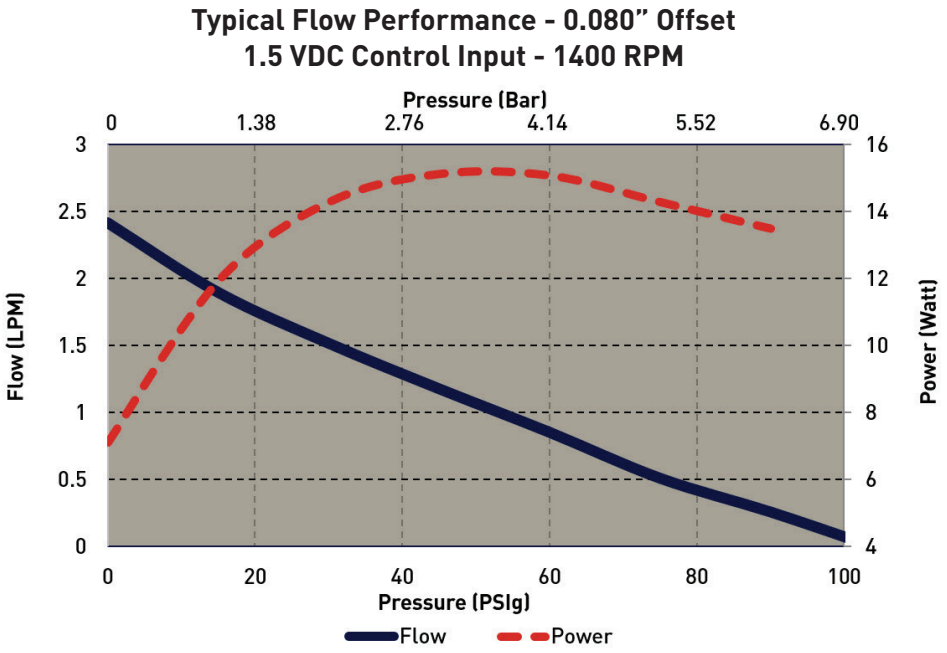
Motor Type (DC):
Brushless DC Motor

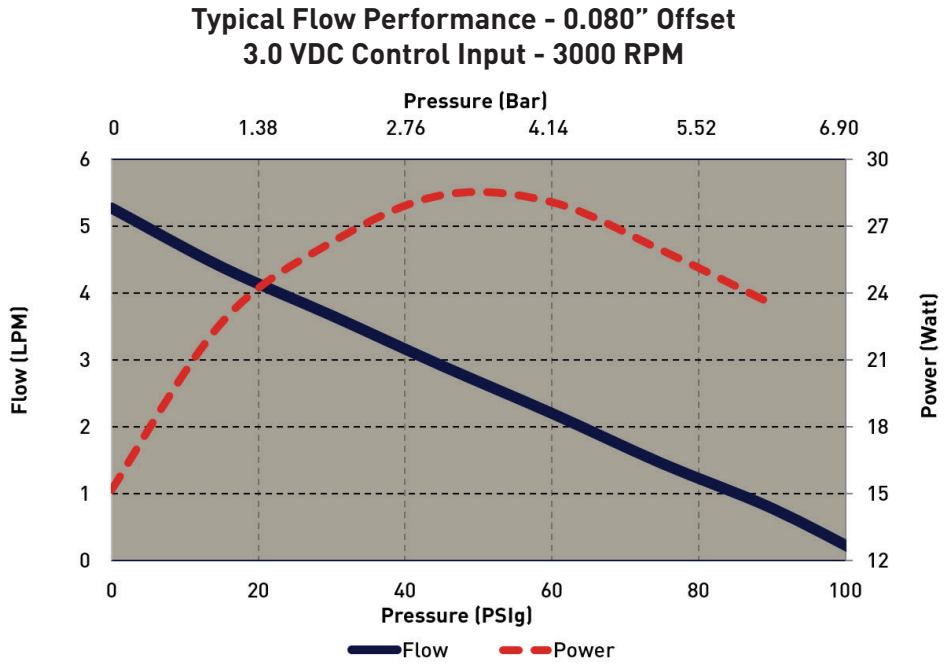
Nominal Motor Voltages:
24 VDC
Other voltages available upon request

Electrical Termination:
4.4 inch (110mm) Wire Length
Connector: Molex 43645-0400
Pin 1: Tachometer Speed (Green)
Pin 2: 0-5VDC Input (White)
Pin 3: + VDC Power (Red)
Pin 4: -Ground (Black)

Electrical Termination:
12 inch (305mm) Wire Length

Typical Flow Curve





- **Curves show flow capability with 0.080" pump offset.**
- **With a 5.0 Vdc control input the pump will operate at approximately 4400 RPM and up to 8.5 LPM, but not recommended for continuous operation.**

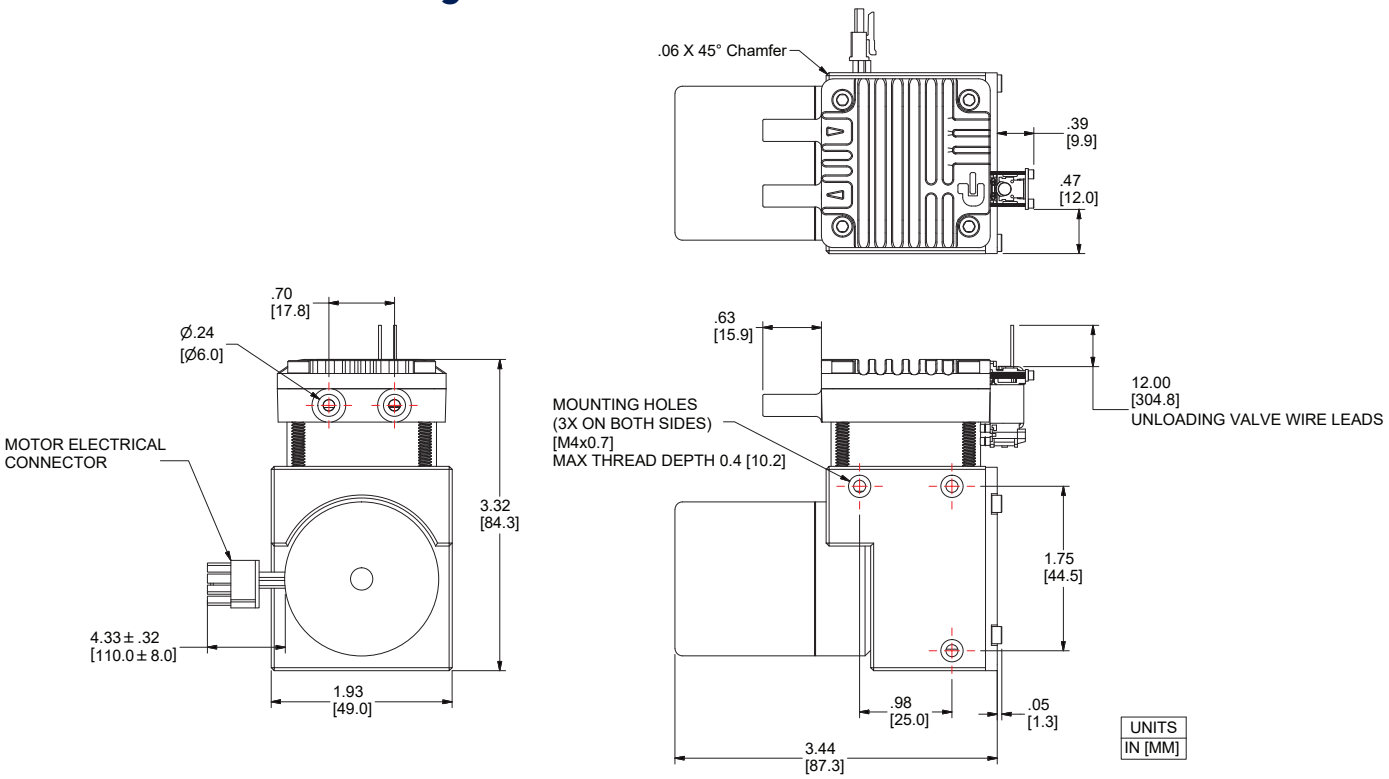
Mounting Guidelines

- Mounting holes are provided on both sides of the pump body. The 6x mounting holes are tapped for M4x0.7 machine screws, with a maximum depth of 0.4 inches [10.2 mm]

Pneumatic Port Connections

- The Helix pump has 2 straight 6mm ports designed to connect with 6mm push-in-fittings
- Parker has a 6mm to 6mm push-in fitting available as an accessory. The port is designed to work with most industry standard push-in adapters.
- Tubing rated for >100 PSIG (6.9 barg) is recommended.

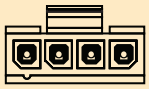
Mechanical Drawings



Electrical Integration and Motor Control

Motor Electrical Connection

Intregrated Electrical Connector	Manufacturer: Molex Housing Part Number: 43645-0400 Terminal Part Number: 43030-0002
Termination	Pin 1: Tachometer (Green) Pin 2: 0-5VDC Input (White) Pin 3: + VDC Power (Red) Pin 4: -Ground (Black)
Wire Specification	UL AWM Style 1006 +VDC and Ground: 20 AWG 0-5VDC Input and Tachometer: 24 AWG



Pin 1 - Connector - Mate side

Motor Supply Power Electrical Details

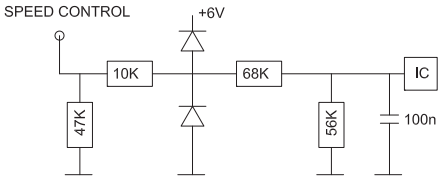
Supply Voltage Range	10-28 VDC
Internal Protection Current Limit	2.3 Amp

0-5VDC Control Electrical Details

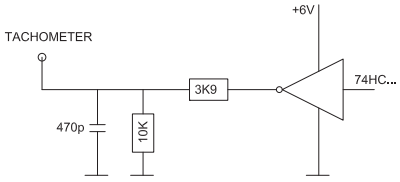
On Board Motor Circuit	0-5VDC input See circuit details below If the input is disconnected (floating input) the pump will not operate.
User Control Circuit	User must supply 0 to 5 VDC analog signal for control

Tachometer Electrical Details

Speed Signal Output	0-5VDC square wave 18 Pulses per rotation of the pump
On Board Motor Circuit	See circuit details below Low signal will be <0.5VDC, High will be >4.0VDC



Speed Control Diagram



Tachometer Diagram

Unloading Valve Electrical Connection

Termination	Stripped and Tinned Non-Polarized
Wire Specification	UL AWM Style 1007 26 AWG, 7 Strand

Unloading Valve Supply Power Electrical Details

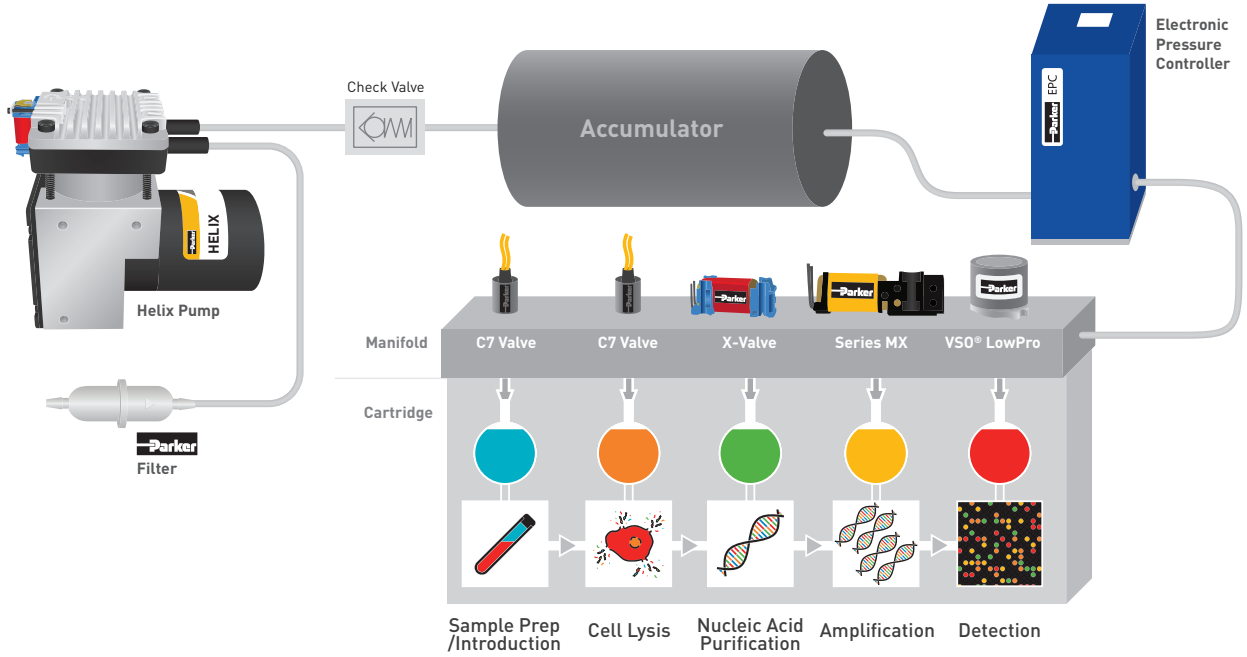
Supply Voltage Range	24 VDC ±10%
Coil Resistance	549 Ohms ±5%

Other Motor Control Considerations

The drive electronics for the BLDC motors are integrated into the motor itself, all that is needed is a power supply with the sufficient voltage and current.

Typical Flow Diagram

Point of Care Test System (POCT)



Application Notes

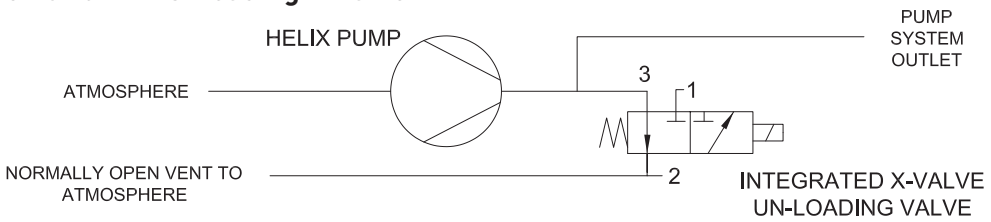
Unloading Valve:

A common application for the Helix is intermittently recharging a pressure accumulator in a compact system. The integrated unloading X-Valve removes pressure from the pump head, allowing the pump to restart against system pressures as high as 100 PSIG (6.9 Barg).

When operating the pump to pressurize the accumulator, the valve should be powered to close the valve. When the charge pressure has been achieved and the pump turned off, the solenoid valve power should be removed, so the normally-open valve will vent the pump internal pressure to atmosphere.

It is recommended to use a check-valve between the outlet and accumulator to hold pressure in the system (the Helix pump is not designed to be leak-tight).

Pump Schematic with Unloading X-Valve:



Operating Conditions

When operating at high pressure (>60 PSIG [4.14 barg]) and high speed (>1500 RPM) the Helix pump may generate significant heat. It is recommended to maintain a head temperature below 105°C. With intermittent operation no cooling should be required; however, if the pump is operated continuously cooling may be necessary.

Accessories Information

A Filter-Muffler is always recommended in the air inlet or outlet to reduce noise and risk of debris that may affect pump performance. Parker recommends 40 micron or better filtration to be used with this pump series.

6mm Push-In Fittings are recommended to connect the Helix pump pneumatic ports to tubing.

P/N: 00492-15
(10 micron Filter)

P/N: 00085-15-0001
(0.01 micron Filter)

P/N: 20934-15
(6mm to 6mm Legris Connector)

Ordering Information

Configuration	Voltage	Motor Control	Speed at Free Flow 3.0 Vdc Control	Part Number	0 Free Flow	15 PSIg 1.0 Bar	30 PSIg 2.1 Bar	45 PSIg 3.1 Bar	60 PSIg 4.1 Bar	75 PSIg 5.2 Bar	90 PSIg 6.2 Bar
 **H1R** Helix Single Head with Unloading Valve	24	0-5 Vdc	2950	**H1R-080P24HV-02**	5.5	4.3	3.6	2.9	2.2	1.4	0.7

Part Number Description

H	1	R	-	080	P	24	H	V	-	02
Model	Pump Heads	Motor Type		Pump Offset	Configuration	Voltage	Materials	Plumbing		Special
H - Helix	1 - Single Head	R - Outer Rotor BLCD		080 - 0.080" Offset	P - Pressure Only	12 - 12 Vdc	H - PTFE, FKM, EPDM	N - None		02 - Analog 0-5 Vdc
								V - Un-loading Valve		

Accessories Ordering Table

Part No.	Description	Comments
00492-15	Filter-Muffler - 1/8" / 4mm Barbs	Filter to 10 microns
00085-15-0001	Filter-Muffler - Straight 1/4" Port	Filter to 0.01 microns
20934-15	6mm to 6mm Legris Connector	Connects 6mm tubing to Helix pneumatic ports

Ordering Information

Please refer to sizing and selection chart for identifying which one will fit your application

To order on-line go to www.parker.com/precisionfluidics/HelixPump to configure your Helix Pump.

Serviceable – PPF products are designed for use through the rated life and Parker does not sell replacement parts, nor is it recommended to service these in the field

Note: In addition to Parker's innovative and flexible pump designs, we offer applications engineering expertise to our customers in order to configure and recommend the optimal pump for the application. Contact Parker Applications Engineering to discuss and configure alternate pump configurations to meet your specific application requirements. Providing information on the following requirements will assist us in developing an optimal solution for your application:

- Noise
- Operating Pressure / Vacuum
- Power Consumption
- Life Requirement
- Size
- Motor Control
- Media
- Voltage

Parker Hannifin Precision Fluidics Division reserves the right to make changes. Drawings are for reference only.

Appendix A

All performance data is typical based on standard conditions: 70°F and 14.7 psia (21°C and 1 bar).

1. Noise is dependent on the configuration and operation of the pump in the application. Parker has the ability to tailor the pump configuration when noise is a critical criterion in the effort to meet the performance requirements of the application. Noise level is tested to Parker protocol P-105.

2. Life rating can vary depending on application and operating conditions.

3. Custom motor options available. Custom motors may require a significant application potential. The standard motors can be configured with a special winding to meet a particular operation point at a specified voltage

4. Maximum intermittent pressure/vacuum data is a pump capability guideline for applications that go beyond the maximum continuous levels for short periods of time. Please consult customer specific requirements with the factory or Applications Engineering.

Learn More at: discover.parker.com/HelixPump

Below are some common specifications that are helpful to have on hand to accelerate your product selection:

- Gas Type
- Maximum Flow Rate
- Inlet and Outlet Pressures
- Operating Temperature
- Standard Reference Conditions
- Process Connection Size and Type
- Set Point Signal
- Digital Communication Protocol Preferences

For more information call **+1 603 595 1500** or email **ppfinfo@parker.com**

Visit **www.parker.com/precisionfluidics**

LTC Series

Up to 1.7 LPM Free Flow

Miniature Diaphragm Pumps (liquid)

Markets

- Clinical Diagnostics
- Analytical Chemistry
- Printing

Applications

- Clinical Chemistry
- Wash and Waste Circuits
- Urinalysis
- Liquid Chromatography
- Large Format Printers
- Photo Processing Printers

LTC Miniature Diaphragm Pumps are offered in both brush and brushless DC motor drives that can be configured for your specific performance requirements and handle a wide range of liquid media over a wide range of pressures. LTC's patented Fluid-Blok™ Advanced Sealing Technology provides redundant sealing capabilities to eliminate potential leaks. Monolithic diaphragm design enables maximum suction, priming, and continuous dry operation. Ideal for waste, transfer and bulk movement of liquids.

Features

- LTC Series Pumps set the highest benchmark for service free life-expectancy with our advanced proprietary diaphragm elastomer.
- Multiple port designs available for simple integration: Barb tubing connection, 6MM compression fitting, or 1/4-28 UNF threads with top and bottom face sealing.
- Overmolded diaphragm eliminates metal components in the wetted path resulting in a design that is inert to variety of media.
- Incorporating the lightweight EZ Mount Accessory facilitates simple system assembly while dampening vibration and reducing noise levels.
- Our 100% oil and grease-free pump and compressor design maintains the purity of your system and are commonly used in FDA-approved systems.
- RoHS Compliant

Product Specifications*

Physical Properties

Operating Environment[1]:
41 to 122°F (5 to 50°C)
Storage Environment:
-4 to 212°F (-20 to 100°C)
Media:
Most Gases and Liquids
Humidity:
0 – 95% Relative Humidity
Pump Assembly Rated Life[2]:
PMDC Iron Core Brush - 3,000 hrs Brushless Slotted - 10,000 hrs
Weight:
7.0 oz. (198 g) single head PMDC Iron Core Brush 5.0 oz. (142 g) single head Brushless Slotted 11.7 oz. (333 g) dual head Brushless Slotted (High Torque)

Electrical

Motor Type (DC):
PMDC Iron Core Brush, Brushless Slotted
Nominal Motor Voltages[3]:
12, or 24 VDC *Other voltages available upon request*
Electrical Termination:
PMDC Iron Core Brush: 22 AWG Wire Leads, Length 10" (254 mm) Brushless Slotted Motor: 22 AWG Wire Leads, Length 20" (508 mm)

Wetted Materials

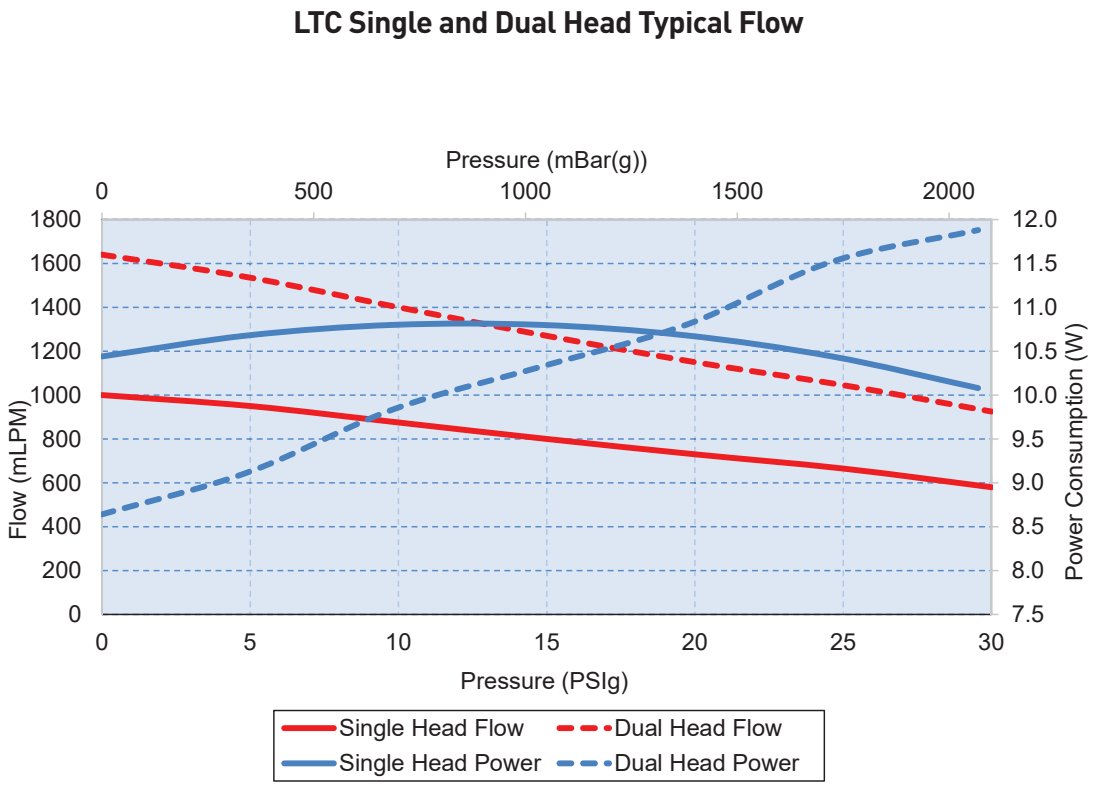
Diaphragm:
EPDM, AEPDM, FKM, PTFE /EPDM Laminate
Valves:
EPDM, AEPDM, FKM, FFKM
Pump Head:
Vectra (Liquid Crystal Polymer)

Pneumatic

Head Configuration:
Single Dual Head
Maximum Unrestricted Flow:
1.0 LPM single head 1.7 LPM dual head in parallel
Pressure Range (Liquid):
0 - 30 psig (0 - 193 kPa)
Vacuum Range (Air):
0 - 14.5 in Hg (0 - 368 mm Hg)
Filtration:
40 microns - recommended

* See Appendix A for details.

Performance Specifications



Typical flow performance is shown with standard high flow configurations with barb ports and brushless DC motor. Performance will vary depending on port and motor selection. Please contact Parker for the typical flow performance for a specific part number and configuration.

All LTC performance data is collected using water at 800 feet (244m) above sea level at 75°F (24°C). Performance will vary depending on barometric pressure and media temperature. Curves are representative of standard pump configurations. Pump configurations could be customized for higher or lower flows, depending on specific customer requirements.

Please contact Parker Precision Fluidics Applications Engineering for other considerations.

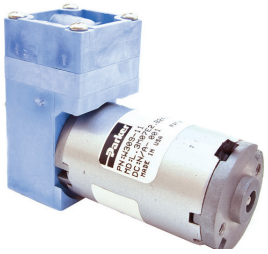
LTC Series

Miniature Diaphragm Pumps (liquid)

Sizing and Selection

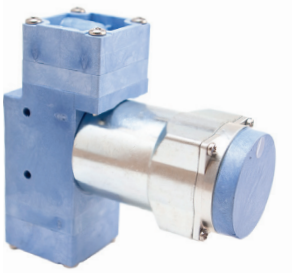
LTC Series

PMDC Iron Core Brush



Brushless Slotted Motor

Brushless Slotted (High Torque) Motor



	PMDC Iron Core Brush	BLDC Slotted Motor	Brushless Slotted (High torque) Motor
Efficiency[1]	Good	Better	High Efficiency at high loads
Life[2]	Good - 3,000 hrs	Best - 10,000 hrs	Best - 10,000 hrs
Cost	Best	Better	Good

Barb Connection

Compression Connection

Threaded Connection

Fittings/ Tubing	6mm OD, 4mm ID (or 1/4" OD)	6mm OD, 4mm ID (or 1/4" OD) Nut, Ferrule, and Retaining ring included	1/4-28 UNF Bottom sealing or face sealing

Mounting Guidelines:

- Bracket options available for mounting consideration (*See EZ Mount catalog pages).*
- Hole in the center of the bottom of housing is for manufacturing only–not to be used for mounting.
- Mounting holes are drilled for #6-20 self-tapping screws with 1/4" (6 mm) thread engagement torque to 4 in-lbs (0.45 N-m).

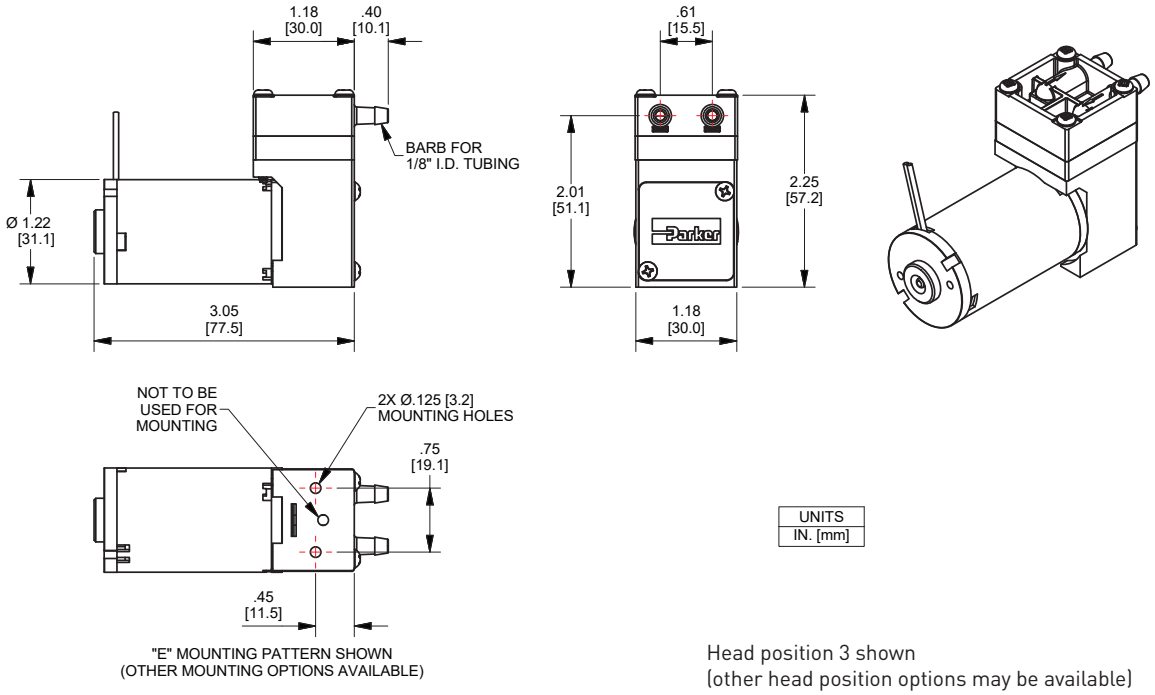
Port Connections:

- Flow direction is marked on the pump head with arrows.
- Barb ports are designed for 1/4" or 6MM OD tubing
- Compression fittings are designed for 4MM ID / 6MM OD tubing
- Threaded ports are sized for 1/4"-28 UNF male fittings.

Mechanical Integration

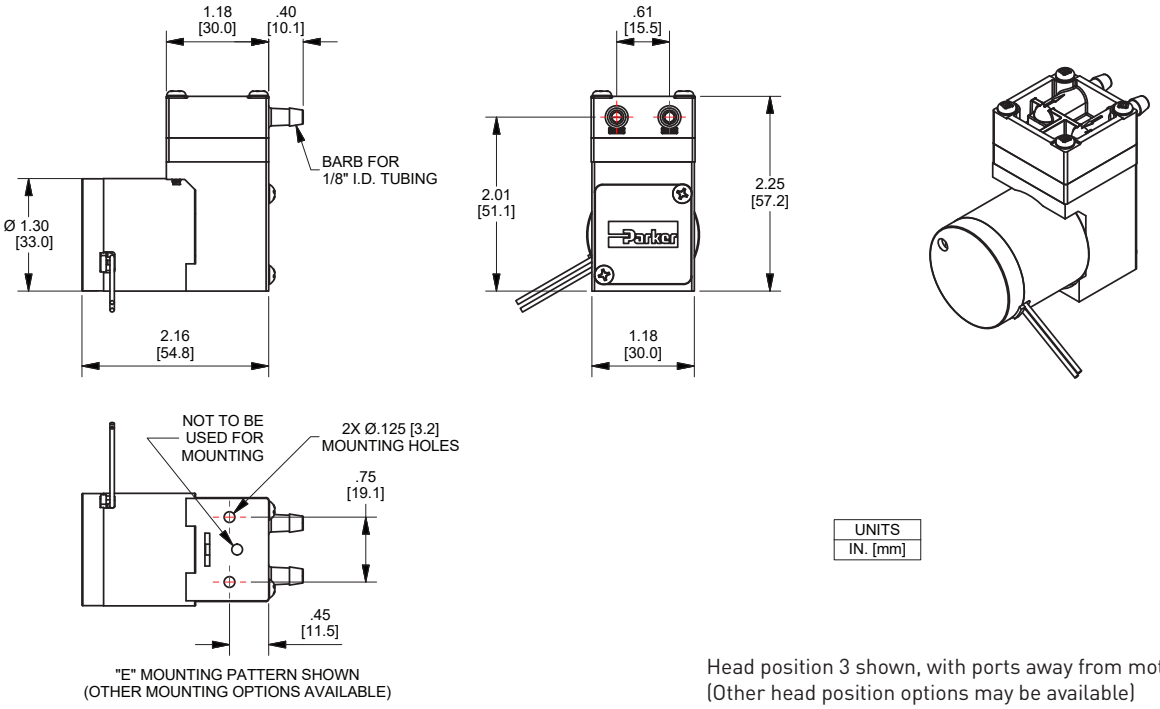
Dimensions

Single head LTC PMDC Iron Core Brush



Head position 3 shown
(other head position options may be available)

Single head LTC Brushless Slotted Motor

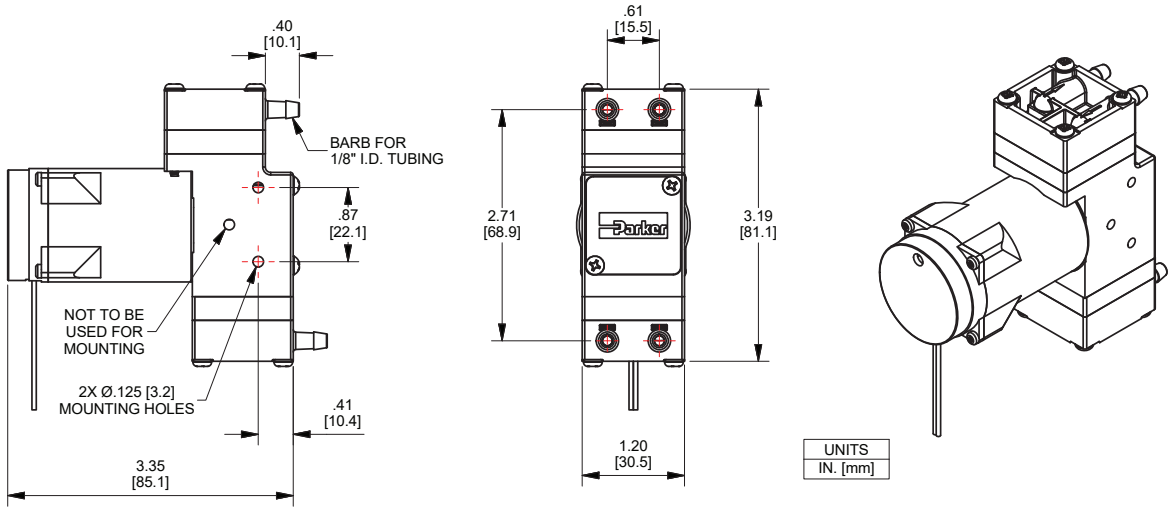


Head position 3 shown, with ports away from motor
(Other head position options may be available)

Mechanical Integration

Dimensions

Dual head LTC-IIS Brushless Slotted (High Torque) Motor



"G" MOUNTING PATTERN SHOWN
(OTHER MOUNTING OPTIONS AVAILABLE)

Head position 3 shown, with ports away from motor
(Other head position options may be available)

Electrical Integration and Motor Control

PMDC Iron Core Brush Motor

2 Wire	Red (+), Black (-)
Wire specification	22AWG, Insulation OD 0.051 in (1.30 mm) 10" (254 mm) Wire Leads

Brushless Motor Control Options

2 Wire	Red (+), Black (-)
Wire specification	22AWG, Insulation OD 0.051 in (1.30 mm) 20" (508 mm) Wire Leads

Other Motor Control Considerations

The drive electronics for the BLDC motors are integrated into the motor itself, all that is needed is a power supply with the sufficient voltage and current.

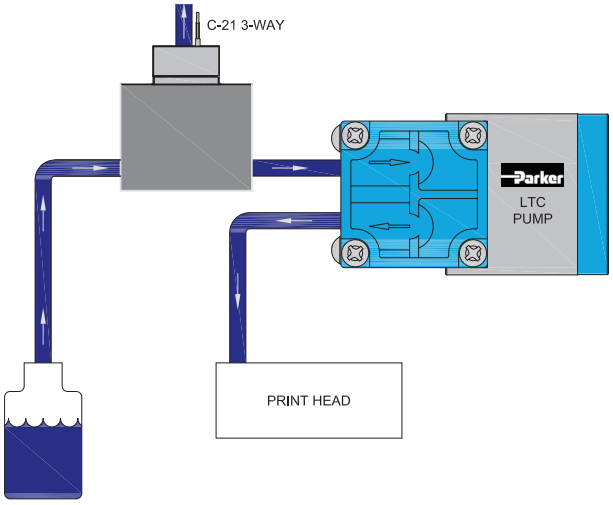
Key Things to Remember

The pump is not a pressure holding device. An external check valve is recommended, if there is a pressure holding requirement.

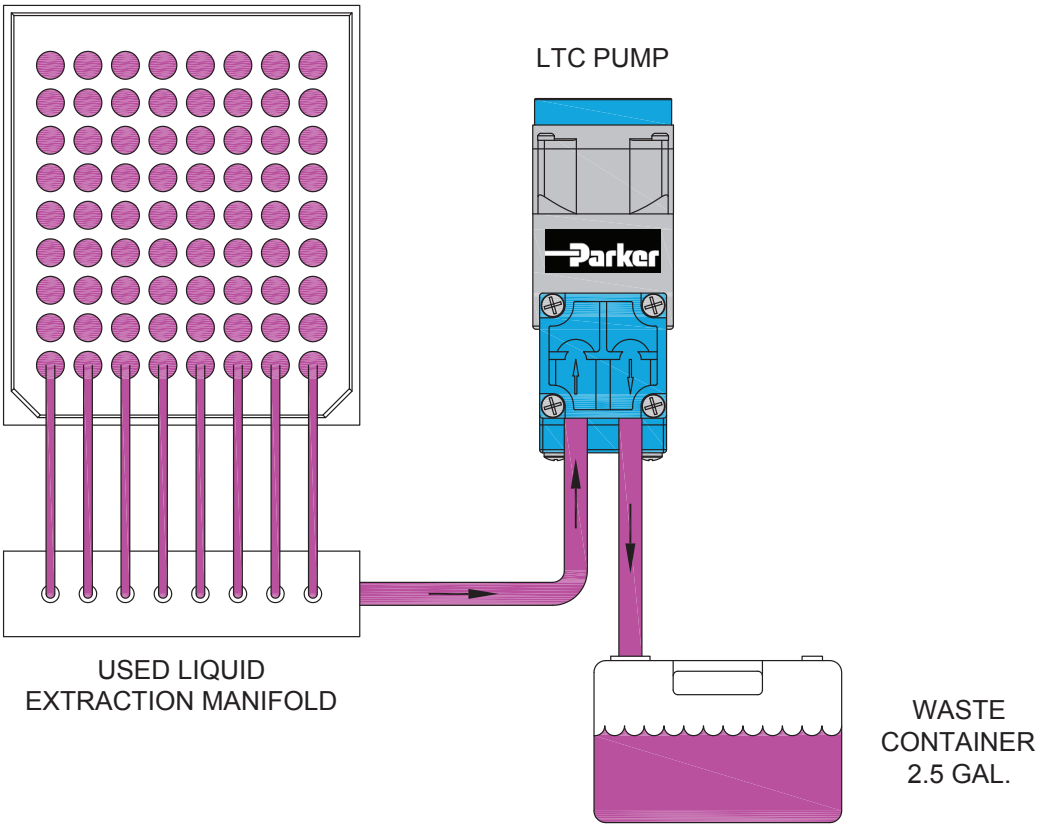
Pump orientation does not affect performance or life.

Typical Flow Diagram

LTC pump used for liquid transfer in a printing application

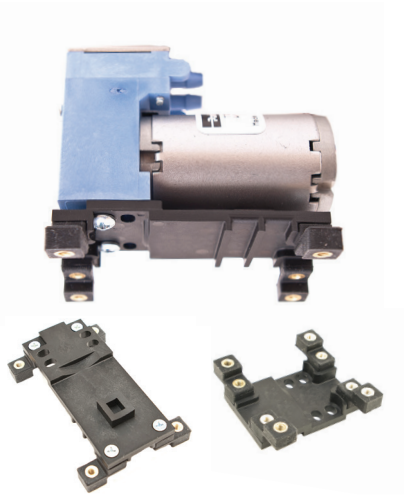


LTC Waste Pump



Accessory Information

EZ Mount available



EZ Mount provides ease of installation and effective control of vibration transfer. EZ Mount was designed to mount easily to the Precision Fluidic LTC Family of diaphragm pumps.

Features

- Isolation feet on the EZ mount can be rotated in any one of three ninety-degree planes and is designed for top-down or bottom-up mounting providing simple installation.
- EZ Mount was designed to minimize weight added to the pump assembly. Approximate weights are: Style A - 0.63 oz (18 g), Style B - 0.71 oz (20 g).
- Effectively absorbs vibration to minimize most vibration-induced noise and vibration transfer into an instrument.
- Designed to keep height and size to a minimum.
- Engineered for Parker LTC and LTC-IIS pumps to ease integration into your system.

Physical Properties

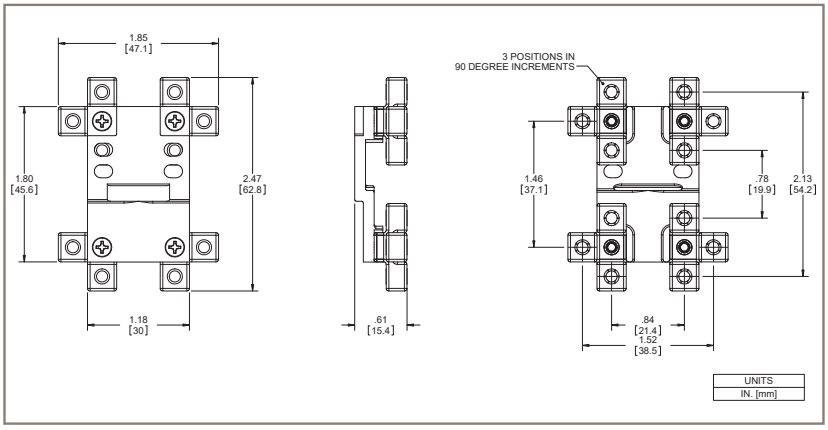
Operating Environment:
41 - 158°F (5 - 70°C)
Humidity:
0 - 95% Relative Humidity
Base Plate:
Noryl GTX830
Feet:
Silicone
Feet Insert:
Brass
Hardware:
Zinc-Plated Steel

EZ Mount kits include all necessary hardware and detailed instructions.

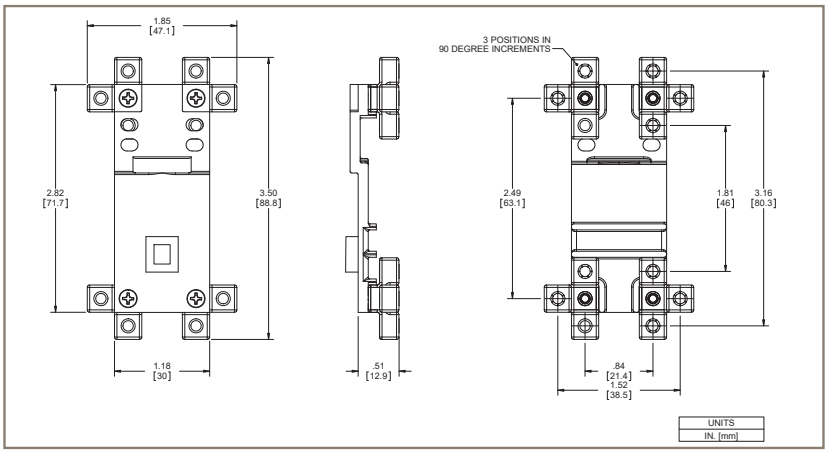
Isolation Feet are available in either threaded or thru-hole clearance for standard #4-40 or #6-32 (M3 for clearance hole only) hardware and can be mounted in any of three ninety-degree planes.

Dimensions

Style A - Brushless Slotted Motor

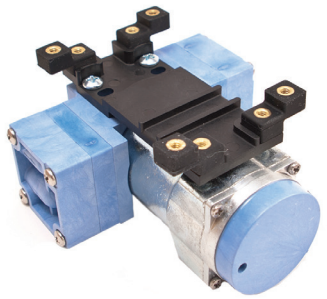


Style B - PMDC Iron Core Brush Motor

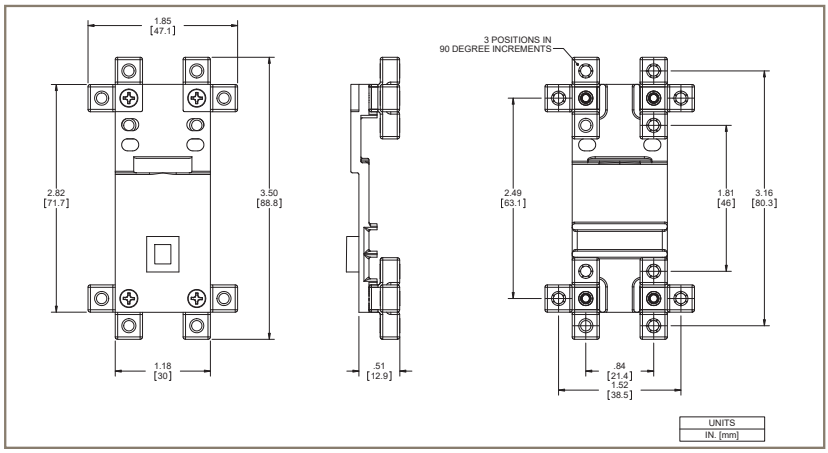


Accessory Information

Dimensions



Style B - Brushless Slotted (High Torque) Motor



Ordering Information

EZ Mount for LTC Single Head Pump with PMDC Iron Core Brush Motor

Part Number	Style	Description
00329-10-A45S	B	#4-40 Threaded
00329-10-B45S	B	#4 Clearance
00329-10-D45S	B	#6-32 Threaded
00329-10-C45S	B	#6 / M3 Clearance

EZ Mount for LTC Single Head Pump with Brushless Slotted Motor

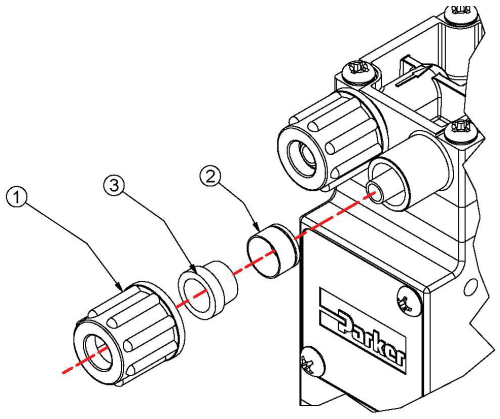
Part Number	Style	Description
00328-10-A45S	A	#4-40 Threaded
00328-10-B45S	A	#4 Clearance
00328-10-D45S	A	#6-32 Threaded
00328-10-C45S	A	#6 / M3 Clearance

EZ Mount for LTC-IIS Dual Head Pump with Brushless Slotted (High Torque) Motor

Part Number	Style	Description
00331-10-A45S	B	#4-40 Threaded
00331-10-B45S	B	#4 Clearance
00331-10-D45S	B	#6-32 Threaded
00331-10-C45S	B	#6 / M3 Clearance

LTC Compression Fitting Spares Kit

1. Black Knurled Nut - 20x
2. Metal Compression Sleeve - 20x
3. Plastic Compression Ferrule - 20x



Part Number	Description	Comments
01842-KT	LTC Compression Fitting Spares Kit, 6MM	Kit includes 20 pieces of each fitting component

LTC Series — Miniature Diaphragm Pumps (liquid)

Chemical Compatibility Chart*

	Chemical Compatibility of Wetted Path Materials Temperature Range 5-50 Degreees C					
Chemical	**FKM**	**FFKM**	**EPDM**	**AEPDM**	**PTFE**	**Vectra A130**
DI Water	1	1	1	1	1	1
Methanol	4	1	1	2	1	1
Isopropanol	1	1	1	1	1	1
Ethanol	3	1	1	2	1	1
Acetonitrile	4	1	1	1	1	1
Organic Acids - Dilute	1	1	1	1	1	3
Non-Organic Acids - Dilute	1	1	1	1	1	3
Bases - Dilute	1	1	1	1	1	3
Saline	1	1	1	1	1	1
Bleach 12%	1	1	1	1	1	3
Ink (MEK)	4	1	1	2	1	1
Sodium Hydroxide 20%	2	1	1	2	1	3

*The above is an Abbreviated Chemical Compatibility Chart. Please consult factory for details. Temperature range for chart is 5-50° C. See Application Engineering for compatibility's with any specific acids or bases.

Compatibility Legend

1. EXCELLENT
   Minimal or no effect
2. GOOD
   Possible swelling and/or loss of physical properties
3. DOUBTFUL
   Moderate or severe swelling and loss of physical properties
4. NOT RECOMMENDED
   Severe effect and should not be considered

Note: Consult factory for other gases.

Ordering Information

Configuration	Voltage	Connection	Part Number	Liquid Flow (Water) mLPM @ Load							FF	Dry Vacuum	Max Pressure (Water)	Wetted Materials		
				0 psig 0 mbar	5 psig 345 mbar	10 psig 689 mbar	15 psig 1034 mbar	20 psig 1379 mbar	25 psig 1724 mbar	30 psig 2068 mbar		inHg	PSIg	Diaphram	Valves	Gasket
Brush Motor 	12	Barb	W311-61	930	865	820	775	705	630	580	17.0	30.0	EPDM	AEPDM	EPDM
	12	Compression	W311-51	965	930	890	830	750	655	605	17.0	30.0	EPDM	AEPDM	EPDM
	12	1/4-28 Thread	W311-11	670	650	600	550	505	450	390	14.5	30.0	EPDM	AEPDM	EPDM
	24	Barb	W309-61	970	890	830	800	730	640	580	17.0	30.0	EPDM	AEPDM	EPDM
	24	Compression	W309-51	930	895	830	780	755	720	690	17.0	30.0	EPDM	AEPDM	EPDM
	24	1/4-28 Thread	W309-11	720	715	685	660	645	585	540	14.5	30.0	EPDM	AEPDM	EPDM
Compact Brushless DC 	12	Barb	W313-61	880	805	780	720	645	585	525	17.0	30.0	EPDM	AEPDM	EPDM
	12	Compression	W313-51	945	900	840	770	665	590	535	17.0	30.0	EPDM	AEPDM	EPDM
	12	1/4-28 Thread	W313-11	640	620	580	510	460	410	370	14.5	30.0	EPDM	AEPDM	EPDM
	24	Barb	W312-61	1000	950	875	800	730	655	580	17.0	30.0	EPDM	AEPDM	EPDM
	24	Compression	W312-51	1030	1000	930	860	790	690	605	16.0	30.0	EPDM	AEPDM	EPDM
	24	1/4-28 Thread	W312-11	640	630	570	510	455	415	375	14.5	30.0	EPDM	AEPDM	EPDM
High Torque Brushless DC 	12	1/4-28 Thread	V015-11	1500	1400	1300	1200	1100	1000	900	11.5	30.0	EPDM	AEPDM	EPDM
	24	Barb	V016-61	1640	1535	1400	1270	1150	1045	925	10.0	>60	EPDM	AEPDM	EPDM
	24	Compression	V016-51	1650	1540	1405	1265	1135	1020	895	11.0	>60	EPDM	AEPDM	EPDM
	24	1/4-28 Thread	V016-11	1500	1400	1300	1200	1100	1000	900	11.5	30.0	EPDM	AEPDM	EPDM

Note: The Ordering Information Section includes a few selected part numbers for the product line. Other performances and configurations are available. Please contact your Sales Representative or an Application Engineer to discuss your application needs.

To order on-line go to www.parker.com/precisionfluidics/ltc to configure your LTC Miniature Diaphragm Pump.

Serviceable – PPF products are designed for use through the rated life and Parker does not sell replacement parts, and these products are not meant to be serviced in the field. Please contact Customer Service with any questions.

Note: In addition to Parker's innovative and flexible pump designs, we offer applications engineering expertise to our customers in order to configure and recommend the optimal pump for the application. Contact Parker Applications Engineering to discuss and configure alternate pump configurations to meet your specific application requirements. Providing information on the following requirements will assist us in developing an optimal solution for your application:

- Noise
- Operating Pressure / Vacuum
- Power Consumption
- Life Requirement
- Description of pump function in the application
- Size
- Motor Control
- Media
- Voltage

Parker Hannifin Precision Fluidics Division reserves the right to make changes. Drawings are for reference only.

Appendix A

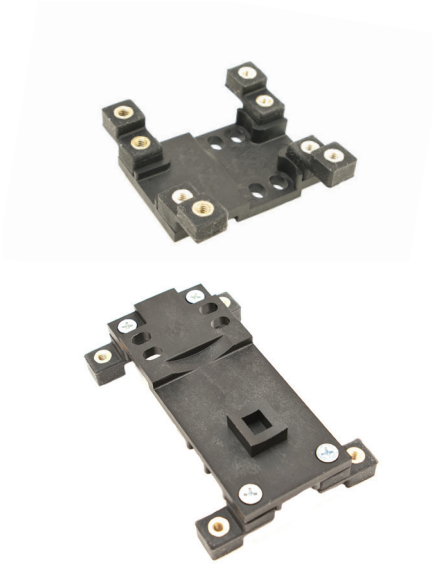
All performance data is typical based on standard conditions: 70°F and 14.7 psia (21°C and 1 bar).

1. Duty Dependent. For operation above 122°F (50°C) consult factory
2. Life rating can vary depending on application and operating conditions.
3. Custom motor options available. Custom motors may require a significant application potential. The standard motors can be configured with a special winding to meet a particular operation point at a specified voltage
4. Current range is dependent on motor type, voltage, pressure/vacuum and flow requirement. Lower levels possible depending on application.
5. Pump efficiency is a measure of the flow rate generated per unit of power consumed. Efficiency may change dependent on application and operating condition at free flow.

EZ-Mount

For BTC/TTC/LTC Series Pumps

Vibration Isolation Mounting System



*Pictured **EZ Mounts** shown fully assembled with baseplate and isolation feet.*

EZ Mount provides ease of installation and effective control of vibration transfer. EZ Mount was designed to mount easily to all Precision Fluidic BTC, TTC and LTC Family of diaphragm pumps.

Features

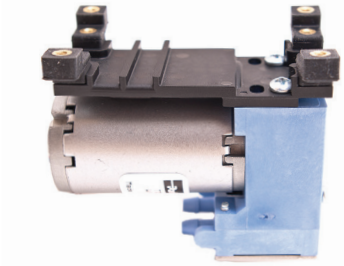
- Isolation feet on the EZ mount can be rotated in any one of three ninety-degree planes and is designed for top-down or bottom-up mounting providing simple installation.
- EZ Mount was designed to minimize weight added to the pump assembly. Approximate weights are: Style A - 0.63 oz (18 g), Style B - 0.71 oz (20 g).
- Effectively absorbs vibration to minimize most vibration-induced noise and vibration transfer into an instrument.
- Designed to keep height and size to a minimum.
- Engineered for Parker BTC, TTC and LTC pumps to ease integration into your system.

Physical Properties

Operating Environment:	41 - 158°F (5 - 70°C)
Humidity:	0 - 95% Relative Humidity
Base Plate:	Noryl GTX830
Feet:	Silicone
Feet Insert:	Brass
Hardware:	Zinc-Plated Steel

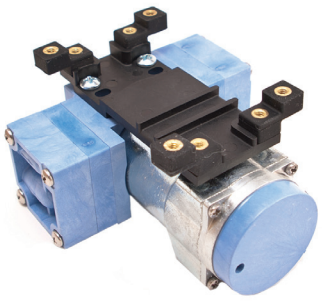
Product Assemblies

BTC/LTC/TTC



PMDC Iron Core Brush Motor

BTC IIS/LTC IIS



Brushless Slotted (High Torque) Motor

BTC IIS /TTC IIS

Brushless DC Motor

EZ Mount kits include all necessary hardware and detailed instructions.

Isolation Feet are available in either threaded or thru-hole clearance for standard #4-40 or #6-32 (M3 for clearance hole only) hardware and can be mounted in any of three ninety-degree planes.

Product Specifications

BTC/LTC/TTC Single Head Pump with PMDC Iron Core Brush Motor

Part Number	Style	Description
00329-10-A45S	B	#4-40 Threaded
00329-10-B45S	B	#4 Clearance
00329-10-D45S	B	#6-32 Threaded
00329-10-C45S	B	#6 / M3 Clearance

BTC/LTC/TTC Single Head Pump with Brushless Slotless Motor

Part Number	Style	Description
01074-10-A45S	B	#4-40 Threaded
01074-10-B45S	B	#4 Clearance
01074-10-D45S	B	#6-32 Threaded
01074-10-C45S	B	#6 / M3 Clearance

BTC /LTC/TTC Single Head Pump and BTCIIS/TTC IIS Dual Head Pump with Brushless Slotted Motor

Part Number	Style	Description
00328-10-A45S	A	#4-40 Threaded
00328-10-B45S	A	#4 Clearance
00328-10-D45S	A	#6-32 Threaded
00328-10-C45S	A	#6 / M3 Clearance

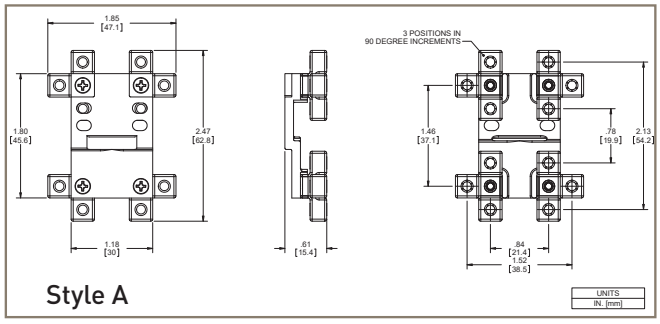
BTC-IIS/LTC-IIS Dual Head Pump with Brushless Slotted Motor (High Torque)

Part Number	Style	Description
00331-10-A45S	B	#4-40 Threaded
00331-10-B45S	B	#4 Clearance
00331-10-D45S	B	#6-32 Threaded
00331-10-C45S	B	#6 / M3 Clearance

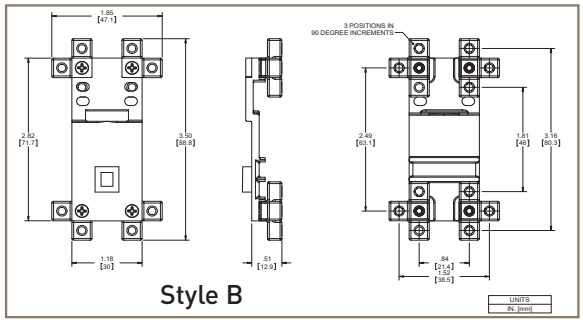
BTC-IIS/TTC-IIS Dual Head Pump with PMDC Iron Core Brush Motor

Part Number	Style	Description
00332-10-A45S	B	#4-40 Threaded
00332-10-B45S	B	#4 Clearance
00332-10-D45S	B	#6-32 Threaded
00332-10-C45S	B	#6 / M3 Clearance

Dimensions



Style A



Style B

Ordering Information

Please click on the Order On-line button (or go to www.parker.com/precisionfluidics/ezmount) to select your EZ Mount Accessory.

WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY, AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or systems in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

PPF MDP - 002/US July 2020

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